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The Institute of Vitreous Enamellers

The Welsh Engineers' and Founders' Association

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Suggestion Boxes

The Minister of Labour has on many occasions stressed the urgent need for co-operation in industry, and amongst many channels along which worth-while efforts can be directed, none shows better promise of fruitful results than a well-organised system of suggestion boxes. The basic principle underlying any such scheme is that it gives the opportunity to every worker in a factory of receiving proper recognition of any improvement carried out in the works due to his or her conception. Moreover, enlightened managements will go further and reward sensible suggestions which, owing to conditions over which the worker has no control, cannot be adopted. Naturally, the scheme must be confined to matters related to improved methods of working, which give promise of the saving of time, material, expense or trouble or promote safety and hygiene. These limits must be clearly understood and accepted, otherwise the system will clash with long-established works traditions and create chaos. The suggestion-box system exists in many large foundry concerns, but has not been extended to the smaller concerns, due no doubt to the fact that personal contact between the owner or his representative and the worker is the rule rather than the exception. One of the major bugbears of the system is when a suggestion relates to a method of wide application and appears to be of a patentable character. This can be taken care of by the larger companies, but for the smaller fry, the legal protection of patentable machines and methods is somewhat expensive and often too much of a gamble to be undertaken lightly. Moreover, an idea, *per se*, is not patentable, and discussion involving the means of carrying out the idea results in a certain amount of confusion as to who was the inventor of the *means*, especially when one party lacks the gift of clear expression. The subject of patents is worthy of discussion by the welfare committees of great works, for it is our belief that new legislation will be forthcoming after the war for modernising a somewhat archaic system, especially as to litigation after the sealing of a patent. Against this bugbear can be placed the mutual benefits which can and do arise from the institution of a well-conducted suggestion-box scheme. Apart from money grants to the successful workers, there sometimes results a concrete daily reminder of his genius or intelligence by its incorporation in works' practice. One of the most difficult problems is the launching of the scheme and the maintenance of interest. As the idea has to be "sold" to the workers, it is advisable to enlist the services of the firm's publicity department.

Concurrently, there must be devised a set of simple rules for display in the works, and quite quickly some awards must be made. For really serviceable notions, it is best to pay an interim award, to be followed at intervals by similar or even larger payments, where the firm can show a distinct benefit from its adoption. It should be made clear that suggestions for better working conditions—money considerations and hours at work excluded—are welcome, for the elimination of a draft or the institution of better lighting or ventilation, can often bring about increased production. An essential to the success of the scheme is the acknowledgment of the suggestions, and anything in the nature of "Dear Sir,—Please note your suggestion hereby acknowledged bears the serial number CA.32. It is receiving the careful consideration of the Committee and its findings will be posted on the main notice board next Friday, etc.," is to be deplored. Rather should an acknowledgment take no standard form, but in its essential must be personal, and one of hundred variants may read: "Dear Mr. Jones,—It was a very nice action on your part to respond so quickly to the invitation to do your bit towards increasing production, and this, of course, means the war effort. Your suggestion for a metal pattern for Job No. XY.44 is now registered as CA.32. After the Committee has looked into your effort, I shall write you again as to what they think about it, etc." Here obviously is a case where the clap-trap jargon of the correspondence clerk should be strictly taboo; it has occurred to but few that the workman seldom or never receives a well-worded letter from any concern with which he has business relations. When suggestions come before the committee for examination they should be impersonal, but intelligent annotation is sometimes advisable to indicate that the sender is a young apprentice, or a newcomer.

Much information of a practical character obviously based upon direct contact with a number of suggestion-box schemes is given in a special publication just issued by the Industrial Welfare Society, of 14, Hobart Place, Westminster, S.W.1. We feel sure that copies will be available to our readers who seek additional information on the subject.

Contents

	PAGE
Suggestion Boxes	33
Correspondence	34
"Science and the War Effort"	34
Institute of Vitreous Enamellers	34
Random Shots	34
Plaster Patterns for Foundry Use	35
The Development and Control of Engineering Grey Cast Irons	37
Piecework and Production in the Foundry	40
The United States Magnesium Industry	41
U.S. Non-Ferrous Notes	42
Control of Iron and Steel	43
Iron and Steel Workers' Supplementary Clothing Coupons	43
Works Maintenance Men	43
British Property in Enemy Territory	43
Applications for Trade Marks	43
New Companies	43
Company Meeting	44
The Week's News in Brief	46
Raw Material Markets	48

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Heat-Treatment Furnaces

To the Editor of The Foundry Trade Journal.

Sir,—In the issue of The Foundry Trade Journal dated January 1, 1942, you published a communication from Mr. C. Webb, of Stein & Atkinson, Limited, commenting on some aspects of our Paper on "Fuels and Furnaces for the Heat-Treatment of Steel Castings." We are indebted to Mr. Webb for this thoughtful contribution, and regret that considerations of space precluded a more complete description of all the modern variations of furnace types.

It is, of course, true that furnace design has advanced considerably during the last few years, and this applies especially to new forms of furnaces incorporating recuperators. Ever since their introduction over 80 years ago, regenerators have been highly popular where high temperatures were required, and the furnaces were large or medium in capacity, but lately the recuperator has challenged this position in furnaces of gradually increasing size.

Furnaces fitted with either regenerators or recuperators naturally work best when the passages are properly cleaned out at frequent enough intervals. We have found that, owing to the stress of wartime conditions, such cleaning is apt to be postponed or hurriedly and incompletely done. The consequent reduction in efficiency is, from our experience, liable to be greater with both regenerators and recuperators of the tubular type than with the older form of regenerator chamber filled with checker bricks, though this, of course, is no fault of the designer of the modern type of furnace.

Where large furnaces are used for the heat-treatment of very large articles, either castings or forgings, the heat-treatment cycle is comparatively long. After a furnace has been shut down to allow the charge to cool, or to be withdrawn, the high heat capacity of large regenerator chambers is advantageous in facilitating the re-lighting of the furnace for the next heat cycle. In small furnaces, where the cycle of operations must be much more rapid if satisfactory outputs are to be obtained, this high storage of heat is undesirable and small regenerators or, in many cases, a recuperator with its still smaller heat capacity, are much more suitable.

Mr. Webb's remarks emphasise the necessity for careful consideration of the types of furnace available before any new furnaces are installed. A modern furnace of high efficiency can be designed for practically any heating process or treatment cycle, but it is essential for the furnace designer and builder to be supplied with the fullest information regarding the duty expected of the furnace and the operating facilities available, if the best results are to be obtained.—Yours, etc.,

T. R. Walker.
F. Smith.

Sheffield,
January 9, 1942.

Moulding Problems in the Electric Steel Foundry

To the Editor of The Foundry Trade Journal.

Sir,—I have read your account of Mr. E. J. Kelly's Paper, "Moulding Problems in the Electric Steel Foundry," with great interest. I am particularly interested in his comments about green-sand moulding.

At the beginning of this section you report Mr. Kelly as saying: "This is practised chiefly on jobs which do not require much machining, or on intricate work to assist contraction." At the end of the section you report him as saying that "strict laboratory control is necessary to obtain full achievement for this excellent method of moulding, which offers unlimited possibilities for the production of highest grade castings." These two statements appear contradictory. The latter is, of course, a true representation of the case, but the first statement may give rise to the impression that green-sand moulding, apart from very light castings, can only be used for cheap, rough work.

This is far from being the case. Some steel foundries produce several thousands of castings weekly in green sand, varying in weight from a few pounds to several cwts., and all are subject to extensive machining and very rigid inspection. Even so, many consider that they are only at the beginning of the possibilities of green-sand moulding.—Yours, etc.,

W. L. Hardy, A.M.I.B.F.

Essex.
January 9, 1942.

"Science and the War Effort"

Last week-end the Association of Scientific Workers held a conference in London on the subject of "Science and the War Effort," which was attended by a large gathering of scientific research workers and engineers from all parts of Great Britain. The main objects of the conference were to give young working scientists an opportunity to discuss the direct utilisation of scientific knowledge and methodology to war production problems, and to explore means for a closer application of such methods to the war effort. Sir Daniel Hall, who presided, said that it was not enough to diagnose mistakes in the present conduct of affairs and to protest that they had arisen from the neglect of science. The real problem for men of science was to find within the machinery of Government the appropriate method of using the expert, he added. A number of Papers, of the many read at the conference, asked for the more effective organisation of science in the war effort, and suggested that much scientific ability was being wasted, not only British ability but also that of the many eminent scientific men refugees in this country. Prof. H. Levy said that at present scientific experts in the Forces were only "back-room men," and were given no scope for full-scale experiment in the field. The British war effort had been hampered by complete ignorance of the power of a planned economy, and the results of planning in Germany and Russia had been watched with amazement. Prof. J. D. Bernal suggested that there still existed in many departments opposition to the scientific way of doing things, which is equivalent to, or even worse than, sabotage.

Institute of Vitreous Enamellers

A meeting of the Southern Section of the Institute of Vitreous Enamellers was held at the National Liberal Club, London, on Tuesday, January 13, with Mr. Alastair McLeod in the chair. Mr. E. R. Francis was elected to take over the duties of the honorary secretaryship from Mr. McLeod. Further discussion was devoted to the survey of the raw materials of the vitreous-enamelling industry, and progress was made in planning the review of the sources, occurrence, properties, preparation and utilisation of the felspars. The next meeting will be held on a date in March to be announced later.

German Foundry Meeting

At a Hannover meeting last year of the Verein deutscher Giessereifachleute, a number of technical Papers were read, including the development of the Maurer cast-iron diagram by Prof. H. Uhlitzsch, materials for I.C.E. cylinders by Dr. C. W. Pfannenschmidt, vanadium grey-iron castings for valve seats by Dr. C. Englisch, new experiences of the drying of moulds and cores by W. Callenberg, electricity in the foundry by Prof. F. Knoops, and compressed air in the foundry by Dr. W. Weichelt.

Random Shots

A very comfortable and prosperous looking man, travelling in a first-class carriage, spent most of a long and tedious journey deploring his sad plight. He was a director of nineteen companies, but was feeling the pinch; he'd never been so hard up in his life, and as to the income-tax—well, it just didn't bear thinking about. His travelling companions were very tired of hearing of all his financial troubles (he looked most maddeningly prosperous), but not even icy glares nor stony silence could stop him. At last a thin ill-dressed man in the corner jumped up exasperated and took down his hat from the rack. Putting a pound note in it, he passed it over to the company director. "There you are," said he, "here's a pound to start off with: If we pass the hat round you'll have at least a fiver to see you through." The company director was quite cross, but thereafter silent.

* * *

The Paper Chase.—The youth of Britain has indulged in paper chases since times immemorial—for recreation and exercise. The Beaver, that indefatigable builder of dams and now of many other things more appropriate to the times, has raised the paper chase not to a national sport, but to a national duty. His voracity for paper is matched only by the Reith's requirements of ferruginous fare. Join the Beaver's paper chase and do your bit with those hoards of waste paper you have religiously stored for just such a contingency as the present. You always say so-and-so will come in handy some day or other; it will, it has now—imperatively and instantly. Hand over your waste paper and feed (and arm) the Beaver to the teeth.

* * *

"What does a bookworm look like?" asked a youngster who was helping to turn out some old books and photographs for the salvage collector. "A bookworm, my dear," replied Father, "is a strange animal; usually long and thin, with very untidy hair and a dreamy look in its eye. It mostly wears glasses."

"Well, whatever it looks like really," replied the incredulous youngster, "I think there's been one in these books. They've all gone brown, and they smell awful."

* * *

It is of interest, at this juncture, to quote the "Times" of 1831, in which it was stated that there were 800,000 female servants in Great Britain. If they are all on munitions to-day, consider that it will take many times more 800,000 tons of waste paper to keep them going, and "go to it"!

* * *

Apprehension is felt in some quarters that the Pacific fleet is to be under American command. It is only a matter of time, it is feared, before the time-honoured "Aye, Aye, Sir," will give place to "O.K., Cap." That would make Nelson, Drake and Raleigh stir in their graves.

* * *

Out Irishing the Irish

A notice recently sent out to the parents of the pupils from a local school read as follows: "Owing to the shortage of milk it is proposed to increase the daily supply of milk to the children from one-third to half a pint.

* * *

In this country the marines are noted for the size of their stories. American marines, on the other hand, have a reputation for toughness, so tough indeed that they are even stated to pin their medals on to their bare flesh.

* * *

The crossword clue of the week comes from "The Times":

Clue: Strange effect of mountains on the sex of birds.

Answer: Himalaya.

"Marksman."

Plaster Patterns for Foundry Use*

A REVOLUTIONARY CHANGE IN PATTERNMAKING

By HENRY PLUCKNETT

Plaster patterns constitute one of the most revolutionary changes in foundry practice during the last half century, affecting not only the present day pattern maker, but also foundry technique. By this method castings can be produced in half and even one-fifth of the time previously taken.

Naturally a number of foundrymen regard a pattern solely as an object to be reproduced in metal, and therefore whether it be made in wood, plaster or metal is a matter of little importance. But the aim of most progressive people is some day to run a department on their own initiative. Then the question of costing and time lag becomes of vital importance, and the pattern plays no small part in controlling both cost, and what is more vital now, "time."

The present speed-up in production also makes it necessary to employ the quickest, yet at the same time most reliable, methods of producing a perfect result.

In using wood, several pieces invariably have to be joined together in such a way that glue must be used. Glue takes several hours to harden, and here, it is suggested, is delay—although in this case unavoidable.

Wood has a great tendency to warp and twist either when left in the damp sand or in the sun. On large surfaces the joints are sometimes left ⅛ in. or even ¼ in. apart to allow for this movement; whereas plaster, once cast and dried, shows very little movement, so that even large surfaces can be made in one piece without even showing any trace of joints.

It may be advisable to point out here that a length of plaster 4 or 5 ft. long and in its green state (that is just after being cast and still damp) will, if not properly supported, sag as much as 1¼ in.

Advantage may be taken of this when allowing for camber; in this case the pattern is "run" quite straight, then both ends are lifted on to supports at the required height, or a saddle may be used to give the desired sweep. Plaster, thoroughly dry, however, retains its shape.

Materials Available

Plaster of paris owing to its natural quick-setting properties, and also to its unique property of reproducing perfectly any surface or shape, appears to be the most suitable material. A very reliable plaster known as "Italian fine" is obtainable at most large builders' merchants, and the address of the local agents will gladly be given to any one who is interested. This material can be controlled at will. By the addition of a little alum in the form of a saturated solution, it can be made to set in 3 mins., whereas, a little size water, will retard the setting for 20 mins., 1 hr. or even 2 hrs.; in fact, 1 lb. of glue to 7 qts. of water will retard the plaster for about 12 hrs., which when set will be so hard that it can be turned and polished like stone. The addition of 10 per cent. finely pulverised marshmallow has the same effect.

A proprietary brand of plaster just recently placed on the market, when dry, has a compressive strength of 17,000 lbs. per sq. in., compared with concrete of 8,500 lbs. per sq. in., after twelve months; a tensile strength of 1,300 lbs. per sq. in. and a Brinell hardness number 35. Here, then, is an ideal material for plate patterns, or for patterns for repetition work. In the case of only six off being required, the plaster used in its natural state, reinforced with canvas, is quite satisfactory.

The most suitable consistency for mixed plaster is obtained by adding about 2 lbs. of plaster to 1 pint of water; and the best method of mixing is to sprinkle the plaster on the surface of the water, allowing it to filter through the fingers to avoid any lumps entering the water. Continue quickly until the plaster appears in a little mound and the water is almost all taken up, then stir quickly, keeping the spoon on the bottom of the bowl to prevent air being beaten in and causing bubbles. This gives a good set with little or no expansion. Extra water should not be added to the gauge, as this results in a weak plaster. On the other hand, if gauged too stiffly by adding more powder than the water will readily take, the plaster will set quickly, with a tendency to warp, twist, or expand during setting, while generating considerable heat.

Scrim is a coarse canvas used for reinforcing plaster, and can be obtained from rope and twine makers in a variety of meshes—the most suitable being ¼ in. square and ½ in. square; both of these grades have their uses for reinforcing. With the open mesh the plaster is easily worked in, but on the finer and stronger canvas a brush should always be used, otherwise air pockets between the surface skin and the canvas are sure to appear.

Plaster is handled in exactly the same way as for decorative architectural work; in fact, all the art of the old-time plaster craftsman is brought into use, including running and double-running, turning and double-turning (wheel), which is very similar to struck work and sweeps in loam moulding. Owing to the present-day form of architecture there is very little call for these various methods and difficulty may be experienced in finding a craftsman, as few apprentices now are initiated into this work.

Besides knowing how to handle plaster, a good knowledge of foundry work is, of course, essential to enable the plaster worker to allow for loose pieces, cores and drawbacks correctly. The ordinary patternmaker, however, after one or two attempts will find plaster can save hours of tedious work; for instance, a broken connecting rod or flywheel is brought in for casting and a new pattern must be obtained. What could be simpler than to make a plaster mould of the broken pieces (placed or fixed together temporarily) and then a plaster replica? The slight alteration in form and size required for shrinkage and machinery purposes takes but very little time as compared with woodwork.

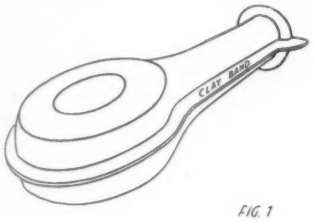

FIG. 1

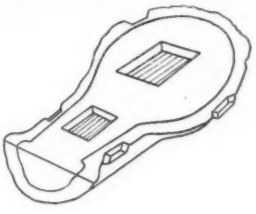
FIG. 2

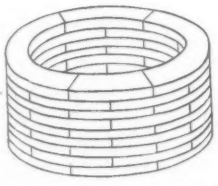
FIG. 3

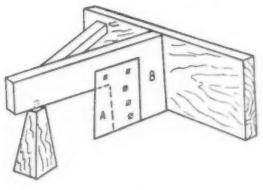

FIG. 4

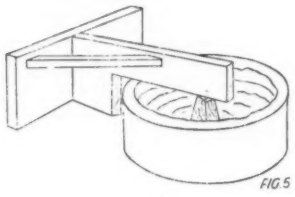
FIG. 5

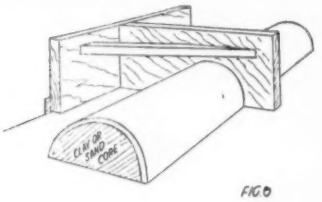

FIG. 6

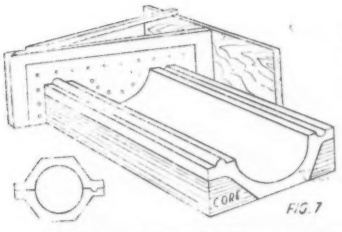

FIG. 7

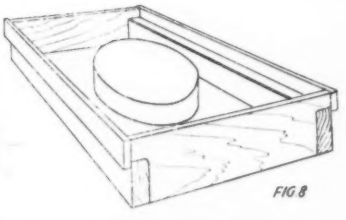
FIG. 8

FIG. 1. MOULD FOR BROKEN CONNECTING ROD.—FIG. 2. SPLIT PATTERN FOR SAME.—FIG. 3. WOOD PATTERN FOR 20-IN. CYLINDER.—FIG. 4. TEMPLATE FOR MAKING PLASTER PATTERN FOR 20-IN. CYLINDER.

FIG. 5. MAKING CENTRAL CORE FOR PLASTER MOULD OF CYLINDER. —FIG. 6. SWEEPING OUT CYLINDER LENGTH WITH HALF-CIRCULAR TEMPLATE.—FIG. 7. CONSTRUCTION OF COREBOX.—FIG. 8. ARRANGEMENT FOR MAKING DROPHAMMER TOOL FOR 3-FT. BRAKE DRUM.

Pattern for a Broken Connecting Rod

To make a mould of a broken connecting rod, the procedure is roughly as follows: Having assembled the broken parts, which may be wired and tied together, the missing pieces are made good with clay or plaster and the bearing cavity filled in the same way. A line corresponding to the centre of the connecting rod is then marked around and a band of clay 1 in. wide and ¼ in. thick is put around as shown in Fig. 1. This half is greased and a ¼ in. of plaster laid over. Another mix of plaster is made and this is splashed over the first coat and the two mixings blended together with a brush. One or two layers of canvas are spread over and the plaster laid on until a uniform thickness of ¼ in. has been obtained. Within 10 minutes or so the job may be turned over, the clay removed, the plaster joint trimmed and two or three joggles cut in the plaster with a knife. The edge is then shellacked and greased and the other half made in exactly the same way as the previous one. When set the two halves may be removed, shellacked and greased, then tied together and filled with plaster. If preferred a split pattern may be made by filling one half of the mould first—

* Paper read before the Wales and Monmouth Branch of the Institute of British Foundrymen, at Cardiff, on January 10.

Plaster Patterns

that is, before tying up. This is levelled off and two joggles made as shown in Fig. 2. When shellacked and greased the second half of the mould is put on top, the two halves tied together and the other half of the pattern poured against the first part.

Making a 20-in. Cylinder

Where repairs and replacements of national importance are concerned, days and even weeks can be saved by this method; no matter how complicated the casting, plaster will reproduce it as quickly as it would a plain surface. Consider the work entailed in making a wood pattern for a cylinder, 20 in. outside diameter with 2 in. thick walls and 9 in. high, such as is shown in Fig. 3. This is constructed out of some 54 pieces of wood glued and pegged together. Each segment is cut from a square of timber some 10½ in. square and 1¼ in. thick. There are six of these pieces to form one ring an inch thick and nine such rings must be jointed up to make the cylinder so that 216 faces must be trued up. Then the rings should be pegged together to embrace all the segments; after all this jointing, preparing and glueing, the whole job must be laid aside for the glue to harden, after which it is turned in a lathe.

How would this be produced in plaster? This is an example of double-running and, first of all, two templates are made, both being outside sweeps. One is the inside diameter (A, Fig. 4, shown as a loose plate), while the second is to the outer dimensions (B, Fig. 4). A central core is turned up, as in Fig. 5, showing the loose plate removed. To do this there is no need to make a solid lump of plaster, so lengths of canvas, dipped into mixed plaster, can be coiled around, coil on coil, until the desired height has been obtained; then with another mix of plaster the surface can be swept true with the strickle. When this is set hard, two or three coats of shellac are applied, allowing several minutes to elapse between each coat. This is followed by greasing or oiling—tallow thinned with paraffin or any sweet oil will serve. Then ¼ in. of plaster is splashed over the core, covering this again with another mix of plaster and a length of scrim bound around once or twice.

The outer surface is then swept up with the outside template. The directness of this type of work is more fully appreciated when the great enemy "time" is considered, and in this case the whole process for a 20-in. diameter cylinder can be carried out in a matter of 5 or 6 hours. As soon as set hard the pattern can go straight into the foundry, where there would be little difficulty in producing a cast the same day if necessary. Such a job is so ridiculously simple in plaster that it is hardly worth wasting time describing the process—but to the uninitiated it is nothing short of a revelation.

Now suppose this cylinder were 3 ft. long and 20 in. diameter, then all that is required is a half-circular template and a length 6 ft. long run on the bench, as shown in Fig. 6. When cut in half, the result is a split pattern, involving 4 or 5 hours' work. Metal dowels can easily be inserted or plaster joggles can be cast on. The prints can be run the same way or swept up on a central pin as the 9 in. high cylinder.

As for the corebox, this is just another simple straight run, as is shown in Fig. 7. These runnings can be made as much as 5 or 6 ft. across, and of whatever length required. Compare this method with the work entailed in jointing, glueing, and then shaping up a similar corebox in wood, and, moreover, compare the times taken.

Clay-Coring

For larger runnings, from 6 in. upwards in girth, the system of clay-coring has been introduced, as this saves weight and plaster. The procedure is as follows:—Two templates are made, one to the finished line, while the other is ¼ in. under the size required. Using the smaller template, a uniform body is built either of wood, clay, or sand, then covered with wet paper. Over this core a length of scrim, dipped into a bowl of plaster, is placed, and while the plaster is still fluid, the larger template is passed over the whole, as shown in Figs. 6 and 7. It may be necessary to run the strickle over the plaster several times before the correct form is achieved, and perhaps another mixing of plaster; this second mixing of plaster will readily adhere to the first mix—it is sometimes much simpler to allow for two or three mixings.

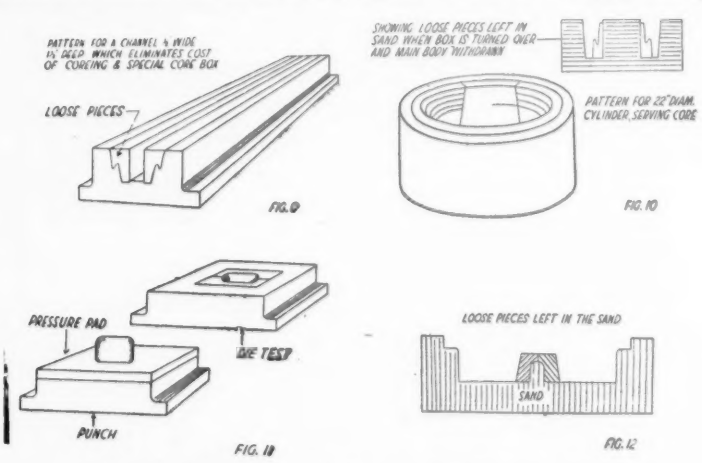
PATTERN 10D A CHANNEL ½ WIDE 1½ DEEP WHICH ELIMINATES COST OF COREING & SPECIAL CORE BOX
LOOSE PIECES
FIG. 9
SHOWING LOOSE PIECES LEFT IN SAND WHEN BOX IS TURNED OVER AND MAIN BODY WITHDRAWN
PATTERN FOR 22" DIAM. CYLINDER SERVING CORE
FIG. 10
PRESSURE PAD
DIE TEST
PUNCH
FIG. 11
LOOSE PIECES LEFT IN THE SAND
SAND
FIG. 12

FIG. 9. EXAMPLE OF DOUBLE-RUNNING.—FIG. 10. EXAMPLE OF DOUBLE-TURNING CYLINDER.—FIG. 11. EXAMPLE OF A PRESS TOOL.—FIG. 12. DIE FOR PRESS TOOL.

Large Patterns

Where large patterns in plaster are mentioned, the question of weight naturally arises. Take, for example, a 2-ft. cube; one would probably think it would weigh 1 or 2 cwts., but this is not the case. There is no need to waste good material in such a manner; all that is required is five squares of plaster ⅛ in. thick, reinforced with one or two layers of canvas. One piece is placed flat on the bench, while the other four are placed around and kept upright and square with bricks or iron weights. Then the joints are covered with canvas dipped in plaster.

Mitering and Jointing.—There is no jointing or mitering, as in woodwork: in fact, gaps of ¼ in. wide are usually aimed for, as it is easier to fill in an open crevice than a small one, and, what is more, it is stronger. To do this filling, plaster is poured into the gap or channel and simply levelled off with a scraper when almost set.

Solid plaster will easily break if given a sharp blow, but a hollow cast approximately ½ in. thick, and reinforced with canvas and strips of wood or builder's laths, can be dropped on the floor with no more damage than a chip off here and there, which a competent moulder in the foundry can easily make good.

Patterns from 6 in. to 6 ft. square are all made by this hollow method, the inside being filled up with sand when being rammed up. Wire hooks or pieces of wood are inserted for withdrawing the patterns from the sand, and on a job 3 or 4 ft. square and 18 in. deep, a 2-in. by 1-in. batten will be found very convenient. When securely fixed by lengths of canvas dipped in plaster, these battens form good handles, and steel whips or wood screws can be inserted and the pattern hoisted out by the crane.

A pattern 4 ft. square and 18 in. deep made on these lines can easily be handled by one man, but, if made solid, it would weigh some 3 or 4 cwts. Thus, not only is the work simplified, but a considerable amount of plaster is saved.

Light Castings

The system for making these light fibrous castings is very simple. Take, for example, the making of a drop hammer tool of a 3 ft. dia. brake drum. The outside of the pattern, if made in plaster or wood, is prepared with several coats of shellac, and then greased, whether it be in metal or otherwise. Then a wall of boards or metal is placed around the pattern, so forming the sides of the tool, as is shown in Fig. 8. Plaster is then laid on to an approximate average thickness of ½ in. Then another bowl of plaster is gauged, adding one or two tablespoons of size-water. This second mix is splashed all over the first ½ in., and the two mixings blended together with a 3-in. or 4-in. brush. It is important that the second be applied before the first coat has properly set; otherwise the face may be left on the pattern.

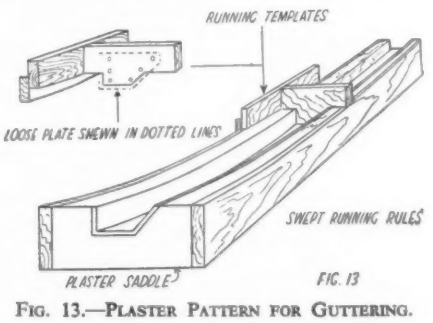

FIG. 13.—PLASTER PATTERN FOR GUTTERING.

Squares of canvas cut to a convenient size are laid in, either dry, or they may be dipped into the bowl of plaster. Whichever method be employed, a brush must be used to bond the surfaces all together—two layers of canvas being quite strong enough for anything up to 6 ft. square. If required a third bowl of plaster may be mixed to thicken up the edges, and fix the battens, etc.

System for Rapping Patterns

Plaster patterns will not stand rapping to the same extent as wood. To overcome this little drawback an entirely new method has been developed. By this system use is made of "slip" or "loose" pieces wherever straight or parallel sides are imperative, such as deep channels, etc. Plaster lends itself to this system admirably, as can be seen by the examples of double-running (Fig. 9), the double-turning cylinder (Fig. 10), and the example of a press tool (Fig. 11).

(*Continued on page* 39.)

The Development and Control of Engineering Grey Cast Irons

PART II—THE CONTROL OF MATRIX STRUCTURE

By R. A. FLINN* and D. J. REESE†

(*Continued from page* 22.)

In the introduction to this Paper, it was stated that the properties of any grey cast iron are dependent on the structure, which is composed of (1) graphite and (2) a ferrous matrix. In the previous section, the matrix was kept constant (as pearlite in most cases) to show the effect of varying the graphite. In the present section, the graphite will be kept constant in the best type of distribution (random flake) and the matrix will be varied. Most of the irons discussed will be in the low carbon range (2.50 per cent. total carbon) since changes in matrix have a more pronounced effect on properties at this low graphite content and, therefore, are observed and interpreted better. (This carbon content also represents the lowest total carbon easily and practicably obtained in the cupola.)

First, the matrix structures, which were available at the start of the investigation, will be discussed (Part 2A), and then the new, very high strength acicular structures will be considered (Part 2B).

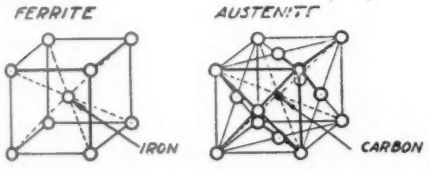

FIG. 8.—ATOMIC ARRANGEMENT OF (LEFT) FERRITE AND (RIGHT) AUSTENITE. NOTE SPACE INSIDE AUSTENITE TO DISSOLVE CARBON ATOM AND LACK OF SUCH SPACE IN THE FERRITE.

Just as in Part I, in studying the effect of graphite, it is well to inquire at the outset what forms of matrix structure are available in grey cast iron, and how their formation may be controlled. At the time the present investigation was begun, the matrix structures which were known were quite similar to those found in steel. The formation of these structures either in the sand cast or heat-treated iron is summarised as follows: Above a cherry red heat (above the range 732 to 815 deg. C.), the matrix of all grey cast iron, whether cooling from the liquid or upon reheating, is practically the same, consisting of a solid solution of carbon, and other elements in the high temperature arrangement of iron atoms (Fig. 8—right) (austenite). When the temperature of the casting falls below 732 deg. C., the arrangement of the iron atoms changes (Fig. 8—left) (ferrite). There is no longer space for the carbon atoms in the new iron structure, since there is an iron atom in the centre of the cubic structure. The carbon enters into a new arrangement and forms iron carbide (cementite).

If the casting is held just below about 704 deg. C., growth of iron carbide is rapid and large, plate-like crystals are formed, interspaced with ferrite (very low carbon) (Fig. 5—right, coarse pearlite). However, if the casting is cooled rapidly to some lower temperature, for instance 593 deg. C., by quenching into a lead bath at this temperature, and holding, the resulting iron carbide plates are finer and a harder stronger iron is obtained. By quenching to lower temperatures and holding at these temperatures, still finer carbide dispersions and harder structures are found. The time which a casting takes to change from the high temperature structure (austenite) to the low temperature structures (ferrite-carbide mixtures) also may be measured, and is plotted in Fig. 9, forming the well-known "S" curve.

From Fig. 9, it is noticed that there are two temperature ranges where transformation is most rapid. The first is near 1,100 to 1,300 deg. F. (593 to 704 deg. C.) and is at the so-called "nose" of the "S" curve, and the second is below 400 deg. F. (204 deg. C.). The great majority of grey iron castings cool slowly

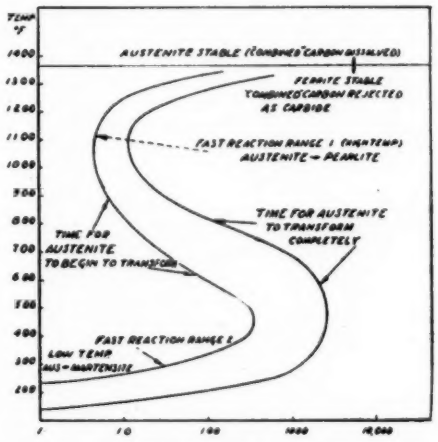
TEMP °F
AUSTENITE STABLE (COMBINED CARBON DISSOLVED)
FERRITE STABLE COMBINED CARBON REJECTED AS CARBIDE
FAST REACTION RANGE 1 (HIGH TEMP) AUSTENITE → PEARLITE
TIME FOR AUSTENITE TO TRANSFORM COMPLETELY
TIME FOR AUSTENITE TO BEGIN TO TRANSFORM
FAST REACTION RANGE 2
LOW TEMP AUS → MARTENSITE

FIG 9.—TRANSFORMATION OF AUSTENITE AT DIFFERENT SUBCRITICAL TEMPERATURES.

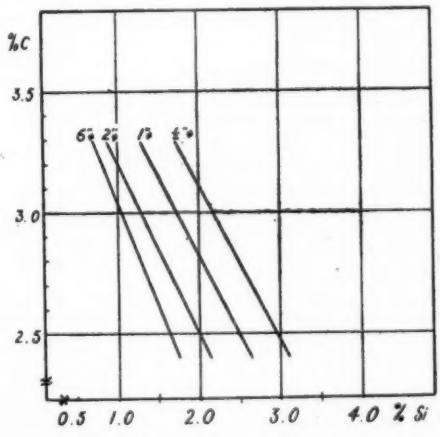

FIG. 10.—CARBON-SILICON RATIOS TO PRODUCE PEARLITE IN VARIOUS SECTION DIAMETERS.

enough so as to transform in the first temperature range and form a relatively coarse carbide-ferrite mixture (pearlite) which is a fairly strong, machinable structure.

If, however, a casting cools rapidly enough through the high temperature transformation range, so that the austenite is unchanged, it will not transform until the low temperature range where the transformation rate is high, and the hard martensite (finest carbide dispersion) will be formed. The control of transformation temperature, and hence, transformation product will be discussed presently.

PART A

Elimination of "Free" Ferrite or "Free" Cementite

In addition to the austenite transformation products just discussed (pearlite of various finenesses and martensite), other structures may be formed in addition to the desired austenite transformation product, if the combined carbon content of the iron is not kept in the range of 0.70 to 0.90 per cent. If the combined carbon is above this range, hard grains of cementite will crystallise separately before the main austenite transformation and produce an iron machinable only with difficulty. If the combined carbon is much below the above range, soft ferrite grains will separate and low gall resistance and tensile strength will result. In addition, as already discussed, ladle inoculation lessens the possibility of free ferrite formation by causing graphitisation of solidification rather than at lower temperatures, by graphitisation of cementite to graphite and low carbon austenite.

The control of combined carbon to the 0.70 to 0.90 per cent. range is effected by control of three variables:—(1) Total carbon—silicon ratio; (2) casting cooling rate; and (3) alloy composition. A proper combined carbon content may be obtained for any one section size (cooling rate) by controlling carbon-silicon ratio. Thus, in Fig. 10, the proper carbon-silicon balance for irons containing 2.30 to 3.30 per cent. T.C. is given for various section sizes poured under given conditions. If, however, a casting with wide variation in section thickness is to be poured, and a correct combined carbon content is desired throughout, either chills, preheating of parts of the mould to level out the cooling rates, or alloy additions, are used.

With moderate nickel-molybdenum additions, the minimum permissible combined carbon content to avoid formation of free ferrite is lowered to 0.55 or 0.60 per cent. On the other hand, in the lighter sections of heavy castings where free cementite tends to separate, the stability of this material is lowered due to the presence of the alloy, and the carbon tends to precipitate as graphite rather than free carbide. By the above methods, a correct combined carbon content may be obtained and the transformation of austenite, containing this carbon in solid solution, may now be considered.

High Temperature or Pearlite Transformation

This type of transformation occurs in over 95 per cent. of the grey cast iron produced to-day. For the composition, the characteristics of which ("S" curve) are shown in Fig. 11, bars were poured from ¼ to 4 in. in diameter. As seen from the microstructures, Fig. 5, the austenite transformed in all cases to a mixture of plate cementite and ferrite (pearlite), but the fineness of the mixture varies. This can be predicted or explained from the "S" curve, as the heavier section, cooling more slowly, transformed at a higher temperature, near 704 deg. C.

In the case of light sections, the cooling rates were too fast for transformation to take place at 704 deg. C. However, at near 593 deg. C., transformation begins and ends in a short time. Consequently, the light sections transformed to fine pearlite in this lower range. Since the castings were already transformed, no changes took place on further cooling. The tensile strength and hardness readings follow this change in

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* Metallurgical Department, The American Brake Shoe and Foundry Co., Mahwah, N.J.
† Development and Research Department, The International Nickel Co., Inc., New York, N.Y.

Engineering Grey Cast Irons

structure, as would be expected, falling from 27.5 tons per sq. in. and BHN 280 in the ¾-in. section, to 17.7 tons per sq. in. and BHN 220 in the 4-in. section (Table III).

Effect of Light Alloy Additions on Pearlite Transformation

For a given section size (cooling rate), the pearlite fineness may be altered by changing the top of the "S" curve (the austenite to pearlite transformation rate). For example, in 1.2-in. diameter bars, Table II, as the nickel content was raised in steps of 1 to 4 per cent., pearlite

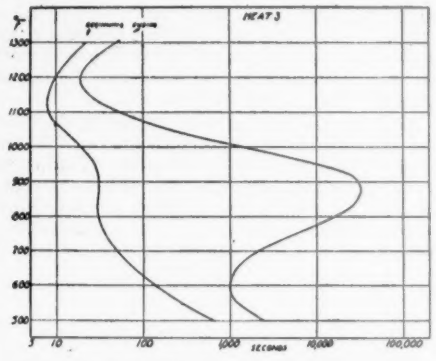


FIG. 11.—"S" CURVE FOR HEAT 3 CONTAINING 2.5 PER CENT. TOTAL CARBON, 2.5 PER CENT. SI, 0.8 PER CENT. MN, 0.1 PER CENT. NI, 0.04 PER CENT. MO, 0.12 PER CENT. CR. NOTE EFFECT OF SMALL ALLOY PERCENTAGES ON ENDING CURVE.

of increased fineness was obtained and physical properties were raised. The "S" curves of Fig. 12 show the general effect of nickel in decreasing the tendency of austenite to transform ("S" curve moved to right). The austenite, therefore, transformed progressively nearer to the nose of the "S" curve (at lower temperatures) to finer pearlite. The effect of molybdenum is also important in this respect, but will be discussed in detail later. The fundamental reason for these effects has been demonstrated by Mehl[1] to be due to the greater difficulty of forming iron-carbide crystals in a nickel-iron or molybdenum-iron lattice than in an iron lattice, and the transformation is therefore slower to begin and to progress.

Low Temperature Transformation of Austenite

If the amount of nickel is further increased to 4.5 to 5 per cent., the "S" curve is pushed so far to the right that the austenite no longer transforms in the pearlite range, but waits until low temperatures. (The tendency to transform in the range between the nose of the "S" curve and low temperatures (204 deg. C.) is slight.) When the austenite transforms at these low temperatures, 204 deg. C. room temperature, the carbide precipitates in an extremely fine form, and produces the hard martensitic structure.* While the Brinell hardness of the pearlites range from 150 to 280 BHN, the hardness of the martensite is over 500 BHN. The value of this hard structure in abrasion resistant irons is familiar to all. It should be mentioned that martensite may be obtained in other ways than by shifting the "S" curve. If the casting cooling rate is changed by water or oil quenching from the austenite range, the time spent in the high temperature transformation range is insufficient, in small sections, to permit transformation, in spite of the high transformation tendency of unalloyed irons. However, the advantages of cooling in sand as compared with quenching are, in most cases, sufficient to warrant alloy cost.

It should be mentioned, for the sake of completeness, that if the "S" curve is moved still further to the right, as by adding 12 per cent. nickel, the low temperature transformation, as well as the high temperature transformation, is suppressed and austenite remains at room temperature.

Since this structure is stable at high temperatures as well as low temperatures, transformation in some cases does not occur on reheating. These structures are superior to unalloyed iron for high temperature service in which the pearlite to austenite transformation occurs and causes consequent stressing of the casting due to the structural change.

The production and control of pearlitic structures with tensile strengths of 22.3 to 31.2 tons per sq. in. and BHN 250 to 300, and the hard, rather brittle martensites of BHN 500, and of austenite tensiles strength 15.6 to 22.3 tons per sq. in. and BHN 150 to 250, have been discussed. The next section deals with the production and control of a new acicular type structure, possessing tensile strength of 40 to 46.8 tons per sq. in. in the Brinell hardness range 280 to 400.

* It is hoped that those who have studied the austenite-martensite transformation closely will forgive this over-simplification of the kinetics and geometry of the reaction.

PART B

The Production and Control of Acicular Type Structure

In 1937, the authors of the present thesis realised that if the strength of machinable grey cast iron was to be raised above 33.5 tons per sq. in., a type of structure other than fine pearlite was necessary. A series of heats, containing 1 to 5 per cent. nickel at 0.30, 0.80 and 1.30 per cent. molybdenum levels, were poured into 1.2-in. arbitration bars and the physical properties contained in Table III were obtained.

With the lower alloy contents, fine pearlites were obtained but with higher alloy contents a new type of structure, called "acicular," was

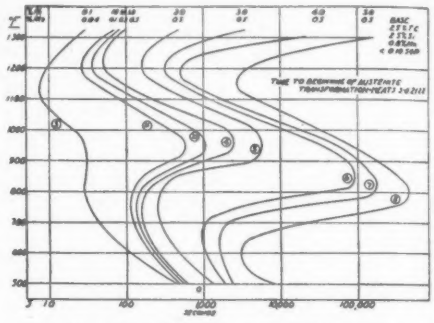


FIG. 12.—"S" CURVES SHOWING EFFECT OF NI AND MO ON BEGINNING OF TRANSFORMATION.

found. Although this acicular structure did not show much higher strength than pearlite in the as-cast condition, after tempering at 260 to 370 deg. C. for over 5 hrs., the acicular irons showed markedly superior physical properties to pearlite similarly treated. As seen from Table III, tensile strengths consistently above 40 tons per sq. in. and up to 47 tons per sq. in. were obtained, which represents values 60 per cent. above the highest American Society for Testing Materials specification for grey cast iron. Transverse strengths of 5,000 to 6,000 lbs. (18-in. span) and accompanying deflections of 0.40 in. are similarly noteworthy. Although scattered photomicrographs of similarly appearing structures had been published[2, 3], none of these investigators discovered the uniquely high physical properties obtainable by tempering at a low heat. In fact, in the case of steels, similar structures had been spoken of as brittle and weak.

TABLE III.—*Properties of High Test Nickel-Molybdenum Irons.*

Heat No.	Composition, per cent.					As-cast				Physical properties. Tempered 5 hours at								[1] Microstructural matrix
										200 deg. C.		260 deg. C.		315 deg. C.		370 deg. C.		
	Ni	Mo	T.C	C.C	Si	*Transverse load, lb.	Deflection, in.	BHN	Tensile strength, tons per sq. in.	BHN	Tensile strength, tons per sq. in.	BHN	Tensile strength, tons per sq. in.	BHN	Tensile strength, tons per sq. in.	BHN	Tensile strength, tons per sq. in.	
11,686	1.07	—	2.24	0.73	2.34	3,820	0.26	273	29.6	—	—	—	—	270	29.0	—	—	Pearlitic.
11,687	2.07	—	2.27	0.68	2.26	3,100	0.20	286	31.9	—	—	—	—	286	31.9	—	—	Pearlitic.
11,688	3.06	—	2.33	0.74	2.29	3,300	0.21	293	31.1	—	—	—	—	293	32.4	—	—	Pearlitic.
11,689	4.10	—	2.27	0.71	2.22	3,300	0.20	302	30.1	—	—	—	—	302	30.7	—	—	Pearlitic.
11,690	4.98	—	2.27	0.62	2.34	3,200	0.24	321	32.1	—	—	—	—	321	32.9	—	—	Pearlitic.
11,691	1.09	0.33	2.26	0.72	2.27	4,050	0.26	286	31.7	—	—	—	—	286	32.2	—	—	Pearlitic.
11,694	1.04	0.81	2.31	0.76	2.30	4,600	0.32	321	36.0	—	—	—	—	321	42.4	—	—	Acicular, 10 per cent. Pearlite.
11,695	1.03	1.36	2.30	0.75	2.31	4,700	0.33	321	32.0	364	37.5	340	—	340	43.8	364	44.3	Acicular.
11,696	2.03	0.32	2.25	0.69	2.23	4,100	0.29	311	30.2†	—	—	—	—	302	34.4	—	—	Pearlitic.
11,697	2.06	0.82	2.28	0.74	2.31	4,600	0.36	340	33.2	418	33.7	364	42.7	364	43.6	321	39.8	Acicular.
11,698	2.03	1.31	2.30	0.77	2.32	4,800	0.35	387	36.6	425	31.5	—	—	382	43.8‡	387	39.8	Acicular.
11,699	3.00	0.31	2.33	0.73	2.36	3,850	0.30	375	—	—	—	—	—	375	39.3‡	—	—	Acicular.
11,700	3.05	0.81	2.25	0.60	2.35	3,800	0.30	418	—	—	—	—	—	387	43.9	395	47.0	Acicular.
11,701	4.05	0.30	2.29	0.70	2.30	3,000	0.25	444	—	—	—	—	—	412	41.2‡	—	—	Acicular.

* 18-in. span. † Flaw. ‡ 15-hr. temper.

Engineering Grey Cast Irons

However, when compositions similar to those used in the laboratory were employed in practice for heavy sections such as rolling mill rolls, a service life, markedly superior to previous cast iron and steel rolls, was obtained in most cases. Moreover, tensile tests of specimens trepanned from various rolls showed that the physical properties of this iron were low, compared with laboratory tests. Metallographic examination showed that the acicular structure had been replaced largely by pearlite, probably due to the sharp transition from the 1¼-in. diameter test castings made in the laboratory, to the 15- to 30-in. diameter commercial castings.

From all these data, it was concluded that while the acicular structure offered a new type of matrix with a high range of physical properties, to realise these potentialities, considerable further research was required. Therefore, in October, 1939, a programme of research was begun under the supervision of the faculty of the Massachusetts Institute of Technology with the following objects:—

(1) To explain the presence of the acicular structure in grey cast iron, and (2) to determine the factors necessary for the production and control of the acicular structure in grey iron castings of various section sizes.

One of the most direct methods of investigating the nature of the acicular structure was to observe the structure while forming. Although a technique has not yet been evolved for microscopic observation of casting structure at temperature while cooling, a good substitute was found as follows: It was known that, with 2.5 per cent. total carbon, 2.5 per cent. silicon, 0.80 per cent. manganese, 0.50 per cent. molybdenum, and 1.5 per cent. nickel, a 2-in. diameter casting would be fully pearlitic, while a 1-in. section would be a mixture of pearlitic and acicular structures. Castings of each type were poured in green sand moulds at 1,426 deg. C. and silica tubes, closed at one end, were inserted into the molten iron. After solidification, chromel alumel thermocouples were slid into the tubes for temperature measurement. Bars of each section size were then quenched into water at 36 to 40 deg. F. when they had reached desired temperatures in the sand. From a study of the structure and hardness of the quenched bars, it was found that the structures existing at the quenching temperature could be derived as shown in Fig. 13.

When austenite was present in the casting before quenching, a very fine, light-etching austenite-martensite mixture of Rockwell hardness C52 was present after quenching, except at the centre of heavy sections. On the other hand, when the austenite had started to transform, the transformation product was found in addition to the fine austenite-martensite mixture.

The 2-in. diameter bars, when quenched from temperatures of 1,093 deg. C. to 704 deg. C., showed untransformed austenite had been present in this range. At 704 deg. C. to 645 deg. C. the austenite started to transform to coarse pearlite, and when this reaction was completed, no further change took place. Therefore, the structure quenched from 600 deg. C. was identical with the sand cooled reference structure.

However, the 1-in. diameter bars showed untransformed austenite from 1,093 deg. C. to almost 600 deg. C., where the austenite began to transform to fine pearlite. This reaction did not reach completion, and at 426 deg. C. the remaining austenite began to transform to the acicular type structure. Finer acicular products are formed continually from the austenite as lower temperatures are reached. In the sand cast structure, some austenite (so called "retained austenite") still persisted untransformed. This retained austenite is important to get high tensile strength by tempering after casting.

From the above results it is evident that the acicular structure is an austenite transformation product which is formed from 482 deg. to 260 deg. C., provided, of course, that some austenite is left in the casting on reaching this temperature range. Furthermore, the casting must spend some time in this range or the formation of the acicular structure also will be repressed and martensite will form at still lower temperatures.

(To be continued.)

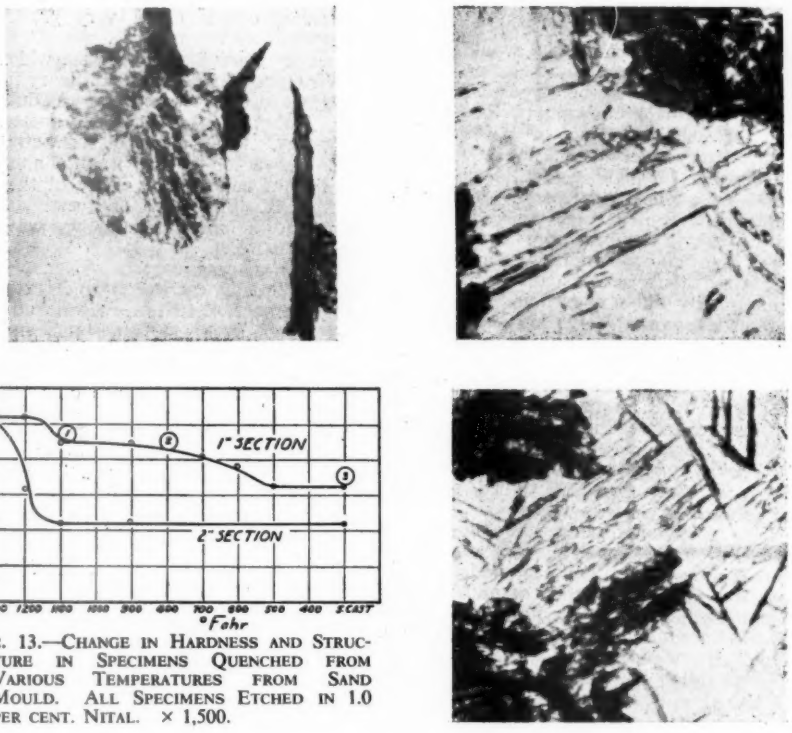


FIG. 13.—CHANGE IN HARDNESS AND STRUCTURE IN SPECIMENS QUENCHED FROM VARIOUS TEMPERATURES FROM SAND MOULD. ALL SPECIMENS ETCHED IN 1.0 PER CENT. NITAL. × 1,500.

Plaster Patterns for Foundry Use

(Concluded from page 36.)

Before going any further, it would be as well to clarify this principle. The press tool (Fig. 11) is quite a good example. There would be no difficulty in producing the punch, or the pressure plate; but the die does present some difficulty owing to the deep recess with parallel sides, but by incorporating slip-pieces the work is made quite straightforward, as can be seen by Fig. 12 showing the sand, with main body removed.

Again examining the cylinder (Fig. 10): In this case the inside has parallel sides, and under ordinary circumstances it would mean coreing, but by making an extra template or loose plate the plaster pattern can easily be turned in two sections in such a way that when the box is rammed up and turned over, the main body of the pattern is removed leaving the slip pieces around the core. These are easily accessible, and being cut into three pieces, there is no difficulty in removing them—leaving the sand in perfect condition.

This method, therefore, saves the time and expense of making a core box, which is considerable on a cylinder of 20 in. dia. It also speeds up foundry production methods considerably, owing to the fact that the making of a separate core has been eliminated.

The advantages of such a procedure can be readily appreciated, as, instead of waiting for the core to dry out, this cylinder could be cast straight away in the green sand. The making of such pieces in wood would make the pattern very costly, as most of the fitting must be done by hand: whereas with plaster, one section is simply cast against another, ensuring a perfect fit.

Supposing such pieces were made in wood; there would inevitably be much trouble caused by warping and twisting due to climatic changes. When such slip pieces are employed, care must be exercised in giving the interior faces a protecting coating of shellac, as three coats of medium consistency add about 0.005 in., and on the two surfaces so treated there would be an addition of 0.010—which is quite sufficient to stop the pieces going back to the proper position.

Another interesting example of speed and simplicity is a pattern for guttering (Fig. 13). Here the camber is run to the predetermined sweep, giving the outside shape. The actual gutter pattern is then run off using the inside template. In this case, while the saddle is only a means of obtaining the outside shape and camber, it could very conveniently be used as an oddside with a considerable saving of time and labour.

In closing, it can be stated that plaster patterns are in many ways far superior to wood, both as a better productive proposition, and also as a means of saving 50 to 70 per cent. of time and also costs, and in the very near future there will certainly be almost a complete change-over from wood to plaster for pattern making.

Air-Conditioning Plant for Blast Furnaces

Inland Steel Company, Chicago, is to instal complete equipment to air condition one of its Indiana Harbour, Ind., blast furnaces. The unit, which can be utilised with either No. 1 or No. 2 stacks, will be used experimentally to determine whether furnace efficiency can be improved by control of air blast moisture. Production of Birmingham, Ala., furnaces has been increased about 7 per cent. by air conditioning, but not much is known as to what may be accomplished in northern sections where humidity is considerably lower. The only other northern installation is at Aliquippa, No. 1, stack of Jones & Laughlin Steel Corp., Pittsburgh, completed early in 1941, and with which favourable results have been reported. The O.P.M. has been considering air conditioning of blast furnaces as a means for obtaining an early increase in American pig-iron production.

Piecework and Production in the Foundry

DISCUSSION OF MR. HALLAMORE'S PAPER

Lincoln section of the East Midland Branch of the Institute of British Foundrymen, with Mr. Codd in the chair, met at Lincoln on December 19 to discuss the debatable points raised by Mr. Hallamore in his Paper "Piecework and Production in the Foundry."

Academic discussion (the limit allowed by the I.B.F. rules) of price allocation, is always a difficult procedure, as the ability to criticise existing systems is naturally affected by personal experience, and to refrain from quoting details of personnel or firms involved tends to reduce the emphasis that is normally felt to be essential when price fixing comes into debate. However, to arrive at any true decision on this subject, the prejudice resulting from personal contact with ratefixing procedure must be dismissed and impartial discussion be derived from summation of the general facts and principles involved in just payment for work done, with particular regard to founding as the trade in question.

Précis of Views

The following précis expresses the final views put forward at the meeting. Payment proportionate to the weight of metal produced is not an intrinsically justifiable system. It does provide a formula for obtaining the average cost per unit weight of castings manufactured, and admirably simplifies the current estimation of production from a comparative standpoint as shown by costing systems. However, it inevitably leads to false conclusions as to the true labour value of the material produced, and hence the ratefixing methods applied must be adulterated to justify the figures predetermined by the accountancy department, giving rise to absurd anomalies in prices fixed.

A plain flywheel and a tank track link may be equated in terms of weight, but the difficulties of production and liability to rejection are ignored, usually to the detriment of one side engaged in their respective manufacture. Assessment of productive value is naturally complicated by the abolition of this easy system of price fixing, but it is emphasised that the greater value of the new estimate will more than repay the staff work required. The only means of just price allocation to any job in production is essentially on an operational time and motion study basis. With numerically large orders the time taken to produce the mould may be taken from trial runs, and the price assessed on this basis. In foundries making heavy castings difficulties will arise as orders more frequently specify single castings, impracticable to price by trial production. However, by keeping a systematic record of time and operations involved in this class of work, prices on new orders may be assessed from the data available on similar work and knowledge of the adequacy of the rate previously used. Here is stressed the need for an experienced and efficient ratefixer. The satisfactory functioning of a time study basis of payment depends on the ability of the ratefixer to quote a price for small orders which he knows will be acceptable and fair both to the moulder and the management.

MR. G. KNOTT, speaking as a foundry ratefixer, crystallised the general feeling of the meeting with a short discussion of the qualities necessary in a ratefixer estimating for production methods, to wit: an adequate grounding in general foundry practice giving a true appreciation of moulding problems and probable snags likely to be encountered in a particular job; ability to retain a moulder's confidence in the fairness of the price offered; a good grasp of business principles coupled with the capacity to offer reasonable prices and quote facts and figures to support their application to the work in question. Moulders should be allowed access to all records of previously fixed prices and given an assurance that price cutting will not result from their ability to earn considerable bonus at any fixed rate. Prices can and must be altered to suit controlling circumstances, and the official ruling states that prices are liable to modification in accordance with parallel alteration of equipment or method of manufacture.

In times of labour shortage, many skilled moulders have to co-operate by doing a fair proportion of their own labouring, and this should alter the price of a job in their favour, with corresponding reaction when the present exceptional conditions no longer prevail. A man should not be penalised if through circumstances outside his control his production of moulds is abnormally delayed, *e.g.*, waiting for the crane to core up, turn over, stove, etc.

Scrap Castings

The question of scrap castings is naturally a vexed one, and requires careful analysis before a suitable system of payment can be devised. A fair division of responsibility would seem to involve inspection of the faulty casting, and the allocation of blame to be dependent on the results of that inspection. If the moulder through neglect, disobedience of set instructions, or unsatisfactory work is at fault, he should be held responsible for making good his own scrap, in line with the official agreement. If the reject is due to conditions outside his influence, he should be paid for the scrap. Mr. Knott, in reply to a question concerning the average man's ability, stated that in his experience such a nebulous quality did not exist in foundries on general casting work. Some approximation of its value in a specialised sphere might be derived from an analysis of light repetition machine moulders, but conditions where individual skill and ability counted as major factors could not lend themselves to treatment under such a loose term as average ability. Every man to his own job is a trite saying which fully answers the question; craftsmen such as skilled moulders cannot be assessed on an average basis.

In light repetition machine moulding, prices can be based on the sizes of the boxes in general use, but this system is liable to sudden breakdown in the event of an influx of unusual jobs. Discussion of this class of work raised the question of the introduction of unskilled labour into a specialised trade such as moulding. In machine moulding the vagaries concurrent with such a situation are not great, as such moulding is semi-skilled and demands only normal capabilities in the newcomer to ensure his attaining satisfactory proficiency in a short time. In hand moulding, however, a special rate for trainees is required suitable to their status as apprentices in a skilled trade and adjustable to their progress in it. It is the joint responsibility of the management and the shop steward to see that the balance between the fully trained men and the trainees is just to both.

Mr. Hallamore's Paper called for a fair price to be demanded for the finished castings graded on their labour value, but the meeting considered this outside the scope of discussion, and concluded that adequate ratefixing throughout the foundry industry as a whole would automatically force a correct solution.

Definition of Steel and Iron Alloys

An order issued by the O.P.M. includes a definition of alloy steel and alloy iron and wrought iron. An alloy is defined as iron or steel containing one or more of the following elements:—"Manganese in excess of 1.65 per cent.; silicon in excess of 0.60 per cent.; copper in excess of 0.60 per cent.; aluminium, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium or any other alloying element in any amount specified or known to have been added to obtain a desired alloying effect."

Blast-Furnace Practice

DISCUSSION BY FALKIRK SECTION

At a meeting of the Falkirk Section of the Institute of British Foundrymen, at Falkirk, on December 19, MR. J. N. HARRIS read a Paper on "Blast Furnace Practice, with Special Reference to the Production of Foundry Irons," which was briefly reported in our last issue.

In the course of the discussion after the Paper, MR. OLIVER, a visitor, said that he had been very interested to Mr. Harris' contention, that the blast did not necessarily require to penetrate to the centre of the furnace, since in the case of cupola control such had been deemed to be a vital requirement. He was also interested in the question of blast temperatures, since if 800 deg. C. could be found satisfactory in some plants, why use a higher one of, say, 1,500 deg. C. in others? No doubt fuel economy was obtained, but would this not be offset by increased maintenance costs?

MR. HARRIS agreed that blast furnace temperatures certainly did vary greatly, but the point of low temperature, say 800 deg. C., resulted in a low Si, high S iron, which would be far from acceptable to the ordinary foundryman. Increase in blast temperature was due to a desire for economical production, and greater fuel economy. Referring to blast penetration, it had been proved that there was definitely no combustion of coke at the centre of the furnace.

MR. R. R. SHAW (Larbert) asked if the Brassert desulphurisation process was an internal or external one.

MR. HARRIS, in reply, said that this process was essentially carried through external to the blast furnace, consisting of the addition of a mixture of soda ash, limestone, and fluorspar, to the molten metal. The constituents, in paper bags, were introduced to the metal ladle, and the molten iron was tapped on to them. The resultant action, which was reversible, forms a slag, which is raked off. Due to the initial excess of soda ash, there was a violent reaction, with the eventual formation of a highly basic slag floating on top of the metal.

MR. R. URE (Carron) asked whether there was much fuel economy, when crushed and graded material was used, as opposed to the normal practice of taking it as it came. He was also interested in the use of the dust from the gas cleaners, and would welcome Mr. Harris' explanation of its use. He personally had seen a stove which had been in use for 21 years, at a temperature of 1,350 deg. F. The stove was as good as new, due to the use of clean gas.

MR. HARRIS said that it was difficult, in blast-furnace practice, to lay a finger immediately on the cause of a fault, but uniformity of material definitely did allow of easier reduction of the ore, in addition to other advantages. The nature of the material determines the extent to which it has to be crushed, the harder material requiring to be smaller. Large lumps of ore often travel to the regions of the tuyeres practically untouched as regards reduction. The fines are usually sintered, to prevent large lumps collecting at any region. Grading of the material reduces the consumption of fuel, as well as increasing the permeability of the furnace, improving the quality of the iron, and generally promoting more regular working conditions. The dust from the gas cleaners usually contains a fair amount of iron, which can be extracted and sintered for reuse. Gas cleaning on a whole is merely a question of economy.

The meeting terminated with a cordial vote of thanks to the author of the Paper.

IRON AND STEEL SCRAP CONSUMPTION in the United States in the first nine months of 1941 totalled 39,858,000 gross tons, which is nearly equal to the total for all 1940 (41,687,000 tons), and exceeds by a wide margin the 26,800,000 tons melted in all 1917, the heaviest year in 1914-18.

The United States Magnesium Industry

A review of the expansion of output, the heavy demand for defence purposes, the growth of utilisation, sources of magnesium, processes and current expansion programmes

The O.P.M. in Washington has announced that United States requirements of magnesium metal are expected to reach 400,000,000 lbs. annually by the end of 1942. This is 62 times the 1939 consumption and equal to about 28 per cent. of the dometsic copper production for 1939. Reviewing the magnesium situation as to production, sources of supply and plans for the immediate future, HERBERT A. FRANKE (Metal Economics Division, Bureau of Mines) points out that commercial production of magnesium in the United States dates from 1915, when imports from Germany were cut off and American firms were obliged to undertake production themselves. In those days, the metal was used chiefly for its pyrotechnic and chemical properties, and as a deoxidising agent in non-ferrous metallurgy. A small quantity also was consumed as an ingredient in aluminium-rich alloys.

Production rose from 87,500 lbs. in 1915 to a record 284,118 lbs. in 1918. After the armistice the industry declined sharply, and output did not exceed that of 1918 until 1926, when 322,650 lbs. were sold or used. During this period, the price of the metal dropped from $5 to 80 cents per lb. In 1926 the demand for magnesium as a constituent in strong, corrosion-resistant aluminium-rich (duralumin-type) alloys increased, and in 1928 the use of magnesium-rich alloys as a structural material also began to assume some importance. Sales of magnesium rose from 530,782 lbs. in 1928 to 908,351 lbs. in 1929. The apparent consumption of primary magnesium in the United States since 1930 is shown in Table I.

Only since 1933 has American industry consumed more than a million pounds of magnesium a year. The two great uses that have contributed most to the expansion in consumption since 1933 are:—(1) The use of magnesium-rich alloys as a material of construction; and (2) the use of magnesium as a constituent of aluminium-rich alloys. Magnesium also is employed (1) as an ingredient in zinc and other alloys; (2) as a deoxidiser and scavenger in removing bismuth from lead and in cleansing copper, brass, bronze, tin-lead solder, nickel, nickel-silver, Monel metal, and aluminium; (3) as a powder in the manufacture of pyrotechnics, such as ammunition and flares; and (4) as a catalytic agent in the formation of complex organic compounds. At one time most of the magnesium consumed was divided among the three last uses.

In 1940, manufacturers of magnesium-rich alloy castings, sheet, extrusions, and other shapes for the aircraft, and other industries utilised 64 per cent. of all the magnesium consumed in the United States. Makers of aluminium alloys took 31 per cent. of which a large part also went to the aircraft industry. The remainder, 5 per cent., was employed as a scavenger and deoxidiser in the metallurgical industry and in zinc and other alloys, chemicals, pyrotechnics, and other applications.

Effects of Technological Advances

Technological progress in the production and fabrication of magnesium and its alloys was indirectly responsible for the great advance in consumption of the metal in 1939 and 1940. Although magnesium alloys have long been recognised for their lightness and good machinability, consumption has been restricted because aluminium and other materials have been available at a lower price, with greater resistance to corrosion, superior mechanical properties, and better-known fabrication technique. During the last few years, however, the magnesium industry has overcome many of its handicaps and made possible broader utilisation of the metal. The price of primary magnesium has declined from 80 cents per lb. in 1926 to 30 cents in 1931 and to 27 cents in 1939. Industrial research engineers and scientists have improved the resistance of magnesium alloys to corrosion to a high degree by the elimination of chloride flux inclusions; development of better alloy combinations; control of harmful metallic impurities; furtherance of new chemical surface treatments; and by fostering the use of better paints and painting schedules. The mechanical properties of magnesium alloys have been improved by new alloy compositions, especially those of high strength and improved chemical stability. Fabricating technique has been greatly advanced, particularly in the arts of rolling and stamping sheet, sand and gravity and pressure die casting, and in gas, arc and electric spot welding. During the last couple of years basic factors of design have been improved, chiefly in regard to structural aeroplane sub-assemblies. These and other technological advances, plus the light weight, adequate strength, and good machinability of magnesium alloy structural products, have given the metal an importance equal to and above that of many other materials.

Of the 7,363,200 lbs. of magnesium used in the manufacture of magnesium-rich structural alloy products in 1940, 5,383,670 lbs. emerged in finished items. The remaining 1,979,530 lbs. (27 per cent.) were lost or burned in the manufacturing process.

TABLE I.—*Apparent Consumption of Primary Magnesium in the United States, 1930–40, in 1,000 Pounds.*

Year.	Apparent Consumption.[1]
1930	460
1931	453
1932	708
1933	1,225
1934	3,100
1935	3,172
1936	2,379
1937	4,216
1938	2,720
1939	6,450
1940	11,154

[1] Does not consider fluctuations in consumers' stocks and metal derived from scrap.

This high loss is due to the fact that magnesium oxidises readily at temperatures above its melting point; however, continued improvements in melting, foundry and fabrication practices should reduce this loss. The gross weight (or the weight of the magnesium plus its alloying constituents) in the finished magnesium-rich alloy structural products manufactured in 1940 totalled 5,916,120 lbs., of which 5,475,530 lbs. were sold or used. The latter included sand and gravity die castings (chiefly the former), 73 per cent.; pressure die castings, 13 per cent.; extruded products, 7 per cent.; sheet, 6 per cent.; and forgings and other structural products, 1 per cent.

In 1930 only 114,464 lbs. of structural products were consumed. The demand grew slowly thereafter, reaching 975,640 lbs. in 1936 and 1,418,391 lbs. in 1937. Of the record 1940 consumption of structional products, the aircraft industry took 75 per cent.; automotive, 10; portable machine, equipment and tool, 6; textile, 3; foundry equipment, 2; and all others, 3. The airplane industry has been the largest consumer of magnesium-alloy structural products for many years, but only recently did the Army and Navy lift very rigid restrictions on the use of magnesium-alloy parts in fighting planes. It is estimated that up to 1,000 lbs. of magnesium are now consumed in each plane.

Boom before Plane Programme

The use of more magnesium per plane and the greatly expanded British and American aircraft programme have actually been superimposed upon an existent boom in general industrial application of the metal. During 1940, manufacturers of textiles, shoes, carpets, rubber goods, optical apparatus, foundry equipment, business machines, motor trucks and other civilian commodities found new uses for magnesium; however, just as these newly created demands were gaining importance, the aircraft industry began to increase its consumption of magnesium, and the shortage that developed discouraged the growing civilian use of the metal. After the emergency is over there will be more magnesium at a lower price than ever before, and these and many other new uses are expected to offer magnesium a promising future.

On March 3 last the Office of Production Management invoked mandatory priorities on magnesium, allocating virtually all available supplies of the metal to defence needs. Nevertheless, it appears that aircraft and other military demands for magnesium will be greater than the supply in 1941. The metal has achieved greater importance in the munitions industry, and in the United Kingdom and Germany probably as much magnesium is used for the manufacture of incendiary bombs as for aircraft. On every trip a large bomber can carry up to 2,000 2-lb. incendiary bombs, consisting of a magnesium-alloy case filled with thermite.

Required Annual Production

Approximately 393,000,000 lbs. of magnesium and 1,073,000,000 lbs. of aluminium over that made in the peak year of 1939 must be produced annually to satisfy the foreseeable potential demand. The role of these two light metals in modern "blitz" warfare had not been fully realised before. Now it appears that the war may usher in an Age for Light Metals. The problem to-day is to expand American capacity rapidly enough to the 1,400,000,000-lb. aluminium and 400,000,000-lb. magnesium goal.

The supply of raw materials for such a huge magnesium-production programme presents no great problem. The United States is richly endowed with magnesium-bearing raw materials, for not only does an inexhaustible supply of sea water abound along its coasts, but there are also large reserves of magnesite, dolomite, brucite (though limited to one large deposit), and magnesium compounds (in various brines, bitterns, and salts). In addition, magnesium is contained in serpentine, olivine, and other silicate minerals from which the metal could be obtained if suitable and economical processes are discovered for separating the magnesium from the silica.

Plans Proposed

The Dow Chemical Company, at present the sole U.S.A. producer of magnesium, obtains the metal from $MgCl_2$ derived from underground brine at Midland, Mich., and from sea water at Freeport, Tex. The chemical engineering division of the Todd-California Shipbuilding Corporation at Permanente, Calif., plans to utilise magnesium oxide derived from Nevada brucite and magnesite and from sea water salt bittern treated by the Westvaco Chlorine Products Corporation, while the Mathieson Alkali Works (Inc.) proposes to add a production unit for metallic magnesium to its ammonia-soda plant at Lake Charles, La., which probably will utilise Texas dolomite as raw material. The International Agricultural Corporation and the Union Potash & Chemical Company are studying the possibility of utilising the large quantities of concentrated magnesium chloride solution available at their New Mexico potash operations. The solution contains 16 to 18 per cent. magnesium chloride. Basic Refractories, Inc., controls large reserves of magnesite and brucite in Nye County, Nev., and it is rumoured that the company intends to recover magnesium therefrom.

Mineral Deposits Available

Brucite, the raw material richest in magnesium, is not at present used anywhere in the world for production of the light metal, evidently because large commercial deposits of brucite are rare. Brucite reserves in the Paradise Range, Nye County, Nev., are estimated by the U.S. Geological Survey at 3,348,000 short tons. The better grade of ore contains 61 to 65 per cent. MgO, 1 to 4 per cent. CaO, 0.7 to 4 per cent. SiO_2, 1 per cent. Al_2O_3, and 0.7 per cent. Fe_2O_3. The brucite is mostly covered by a blanket of hydro-magnesite, and reserves of magnesite occurring in conjunction with the brucite total possibly 71,000,000 tons. This magnesite contains 40 to 47 per cent. MgO.

Magnesite occurs in Nevada near the Muddy River in Clark County, to an estimated total of 35,730,000 tons, averaging 30 to 38 per cent. MgO. Another deposit in Clark County near St. Thomas contains about 500,000 tons of ore. The magnesite deposits near Chewelah, Stevens County, Wash., are estimated at 3,000,000 tons of commercial refractory ore and several million tons of low-grade ore. Other data indicate that the low-grade ore carries

United States Magnesium Industry

34 to 40 per cent. MgO, and the high-grade ore 43 to 45 per cent. MgO. Little data are available on the tonnage of magnesite in California, which occurs as fine-grained veins and masses associated with serpentine in the Coast Ranges and parts of the Sierras and as bedded deposits in San Bernardino and Kern Counties. Occurrences are reported in numerous California counties, and, although only some of these are important, reserves in the State probably will total several millions of tons and include considerable high-grade ore. Magnesite is employed in the production of metallic magnesium in Germany, France, Switzerland, and Japan, and doubtless will be so used soon in the United States.

Dolomite, the double carbonate of magnesium and calcium, and high-magnesia limestone occur in large deposits scattered all over the United States. Cessation of imports of European magnesite forced the United Kingdom to begin using dolomite in the production of its magnesium metal. Italy and possibly France also employ dolomite.

Reserves in Brines, etc.

All present American magnesium production is based upon briny raw material. In addition to the unlimited supply of sea water in the United States, reserves of magnesium in brine, bittern, and salt are quite large. Langbeinite ($K_2SO_4.2MgSO_4$) and sylvite (KCl) solutions are base-exchanged to produce sulphate of potash and magnesium chloride at one New Mexico operation. A substantial quantity of metallic magnesium could be recovered from the excess magnesium chloride produced here. Waste magnesium salts probably are available from various salt and saline operations in Michigan, California, Utah, Ohio, Kansas, West Virginia, and other States. Other potential ore bodies are the closed lake basins, such as Great Salt Lake, whose waters vary considerably, depending upon the location, and may contain from 0.6 to 3.2 per cent. magnesium. The major part of the world production of magnesium probably is derived in connection with potash, salt, and saline operations. Potash waste liquors are employed in Germany and possibly France; sea water in the United States, Japan, the United Kingdom, and possibly Italy; underground brine in the United States; and lake brine in the U.S.S.R.

Olivine and serpentine contain a substantial percentage of magnesium locked up as a silicate. It remains to be seen whether economical processes will be found for the extraction of the magnesium from these and from other magnesium silicate materials. There are enormous quantities of these raw materials in the United States.

Use of any particular magnesium-bearing raw material hinges upon economic and industrial factors peculiar to each individual process. Some of the auxiliary materials that are important in various processes include: cheap power, natural gas or oil, lime, hydrochloric acid or chlorine, and salt deposits and such reduction agents as carbon, calcium carbide, ferro-silicon, or aluminium. Factors likewise to be considered include the location of the magnesium raw material relative to the market, the proximity of water and rail transportation, and other industrial facilities.

Processes for Production of Magnesium

Two basic processes are now employed in the production of magnesium—the electrolytic chloride and the direct electrothermic oxide reduction—both of which involve the use of intricate and costly equipment and call upon the skill of highly trained technical personnel. The Dow Chemical Company utilises the electrolytic chloride process. At Midland, Mich., the bromine and the sodium and calcium salts of brine pumped from underground wells are first removed by evaporation, filtration, and fractional crystallisation. The purified magnesium chloride solution is concentrated further by crystallisation, and the $MgCl_2.6H_2O$ thus formed is partly dried. The drying operation is difficult, and information on drying of the hexahydrate and introduction of the almost anhydrous magnesium chloride into the electrolytic cell is closely guarded. At Freeport, Tex., sea water is treated with milk of lime to precipitate magnesium hydroxide. The latter is chlorinated, made almost anhydrous, and electrolysed by the same method employed at Midland. In Europe, some magnesium oxide recovered from magnesite, dolomite, or sea water is chlorinated in the presence of carbon to produce an absolutely anhydrous magnesium chloride, which is then treated electrolytically in a fused salt bath.

Although the direct electrothermic oxide reduction method has received the most attention during the last few years, the chloride process continues to contribute most of the world metal output. The electrothermic process also involves many problems, the outstanding one being that it is based upon a chemical reaction easily reversible, and a reducing or inert environment must be maintained throughout to prevent re-oxidation. Carefully controlled temperatures and vacua are essential to produce results and to prevent violent explosions. There was a disastrous explosion in August, 1939, at the pilot plant at Radenthein, Austria, where Hansgirg invented his electrothermic reduction process. Briefly, the Hansgirg process involves reduction of magnesium oxide with carbon in an electric arc furnace at a temperature above 1,900 deg. C. and sudden chilling of the metallic vapour formed to 200 deg. C. in a hydrogen or other inactive atmosphere. The condensate contains carbon, magnesium oxide, and other impurities which must be removed in a second distillation furnace. The Hansgirg process is to be employed by the Todd-California Shipbuilding Corporation, but the plant now under construction at Permanente, Calif., will use natural gas instead of hydrogen to shock-cool the magnesium vapour. Patents have been issued on numerous modified electrothermic processes which have been worked out in the laboratory or in small-scale pilot plants.

The Bureau of Mines completed construction on its laboratory-size magnesium pilot plant at Pullman, Wash., late in the spring of 1941 and early in July, 1941, made its first uninterrupted test run. Magnesium oxide is treated in this plant by the relatively new electrothermic process, and the experiments conducted are based on the use of a spray of oil instead of the more highly explosive hydrogen in shock-cooling the metallic vapour produced in the process. The Bureau has completed studies that make it possible to beneficiate low-grade magnesite ore by flotation. The flotation concentrate can be utilised in the production of metallic magnesium or high-grade refractories.

Electric Energy Requirements

The unit electric energy requirements for aluminium and magnesium are the highest of the large-tonnage products in the electrochemical and electrometallurgical industry. Authoritative data are lacking on the exact power requirements for producing one short ton of magnesium, but consumption figures ranging from 20,000 to 30,000 kw.-hr. have been mentioned for the electrolytic chloride process and 19,000 to 22,000 kw.-hr. have been reported for the electrothermic oxide process. Approximately 500,000 kw. of additional installed power probably will be needed to increase the magnesium output from the present productive capacity to 400,000,000 lbs. annually. The Government already is confronted with the problem of providing enough power (715,500 kw.) to permit production of an additional 600,000,000 lbs. of aluminium.

Undoubtedly construction of the proposed magnesium plants will be assisted by priorities on steel and other needed materials. Nevertheless, the new programme may be delayed somewhat because other industries also are receiving preferential treatment and manufacturing facilities are limited. Perhaps the procurement of large transformers, rectifiers, other electrical products, and furnace equipment will cause the most serious bottleneck.

Expansion Programmes

Although a number of American concerns displayed interest in the production of magnesium early in 1941, only the Dow Chemical Company and the Todd-California Shipbuilding Corporation committed themselves to definite expansion programmes. Dow has increased its capacity appreciably. The annual production of the company advanced from 6,700,122 lbs. in 1939 to 12,521,726 lbs. in 1940, and an output of 30,000,000 lbs. is anticipated in 1941. The annual production rate has risen from approximately 13,000,000 lbs. in February, 1940, to exceed 30,000,000 lbs. in June, 1941. Early in 1942 Dow expects to be producing at an annual rate of 52,500,000 lbs. and Todd-California at a rate of 24,000,000 lbs. The Office of Production Management wants at least 323,500,000 lbs. added to this 76,500,000-lb. capacity

(Concluded in next column.)

U.S. Non-Ferrous Notes

Finishing Magnesium Die Castings

Magnesium die castings, left to mild atmospheric weathering, gradually acquire a layer of oxide, hydroxide or carbonate which protects them from further attack, says H. W. Schmidt in a Paper submitted to the corrosion of non-ferrous metals section at the recent A.S.T.M. Chicago meeting. For most applications, however, the parts should be finished in some manner. The method adopted will depend on the requirements to be met. Die castings used for interior applications such as business machines, household appliances, etc., are given finishes chosen for their decorative appeal and wearing qualities. For the various exterior applications protective finishing becomes more important and decorative considerations become secondary. All phases of metal finishing in use on magnesium die castings are discussed, including preliminary mechanical finishing, cleaning, chemical treating and organic finishing.

Materials Substitution

The materials substitution programme started two years ago by the Bell System in America has made possible diversion for use in defence work in 1941 nearly 850 tons of aluminium, 150 tons of nickel, 8,300 lbs. of magnesium and 1,500 tons of zinc. Additional reductions in the amount of these metals used in 1942 are foreseen. Total saving of aluminium is enough to build more than 275 military planes. Replacement of the aluminium "finger wheel" on dial telephones with steel will alone save 65 tons of aluminium annually. Reclamation activities of the Nassau Smelting & Refining Company include 6,000 tons of copper-wire bar; 9,000 tons of lead alloy for cable sheathing; 1,000 tons of lead sleeving for cable splices; 2,500 tons of bronze-wire bar; 250 tons of brass billets; 1,500 tons of solder; and more than 187 tons of redistilled slab zinc.

Storage of Castings

Unfinished brass castings to be made into bearing bushings in the underground machine shop at an American colliery are stored in a compact steel rack, where they are segregated in properly identified groups kept definitely apart and yet handy to the reach. Bushings of a certain size are threaded over a steel rod with a loosely pivoted joint at the back end and with the front end resting in a notch. A label at each notch on the vertical front bars of the rack tells for what purpose the castings on that rod are intended. A casting is removed by lifting the outer end of the bar with one hand and slipping the casting off with the other.

A.S.T.M. Copper Casting Specifications

The latest serial designations sponsored by the A.S.T.M., with their titles, are as follow:—B 143—41 T—Tin-bronze and leaded tin-bronze sand castings; B 144—41 T—High-leaded tin-bronze sand castings; B 145—41 T—Leaded red brass and leaded semi red brass sand castings; B 146—41 T—Leaded yellow brass sand castings for general purposes; B 147—41 T—High-strength yellow brass and high-strength leaded yellow brass sand castings; B 148—41 T—Aluminium-bronze sand castings; B 149—41 T—Leaded nickel-brass (leaded nickel-silver) and leaded nickel-bronze (nickel-silver) sand castings.

THE ANGLO-AMERICAN CORPORATION has recently established a joint laboratory for non-ferrous metallurgical research in connection with the three Northern Rhodesian mines under its administration, *viz.*, Nkana, Nchanga and Broken Hill. The Corporation mines a variety of non-ferrous ores, mainly copper.

(Continued from previous column.)

by the end of 1942. Both Dow and Todd-California probably will share a portion of the new expansion programme, which is being planned by the Office of Production Management, the War Department, and the Defence Plant Corporation. In fact, the Todd-California Shipbuilding Corporation has requested the Bonneville Power Administration to reserve Bonneville-Grand Coulee power for the production of 24,000,000 lbs. of magnesium in the Pacific Northwest if its new California operations are successful. Basic Refractories, Inc., Mathieson Alkali Works (Inc.), International Agricultural Corporation, and other concerns may also participate in the huge Government-sponsored magnesium expansion programme.

Control of Iron and Steel

MODIFICATIONS OF NO. 15 ORDER

The Minister of Supply has made the Control of Iron and Steel (No. 18) Order, 1941, which came into force on January 5, 1942. This Order varies the existing Control Orders by removing from their scope molybdenum and tungsten metal, except in powdered or sintered form, as by arrangement other forms of these metals will in future be dealt with by the Ministry of Aircraft Production. The quantity and value of tinplate, terneplate, etc., which may be purchased without licence has not been reduced, but, instead, consumers will be permitted to purchase 13 double boxes in a month from any source instead of being confined to 39 double boxes in a quarter from stockholding merchants only.

Certain adjustments are made of the extras to the prices scheduled to the No. 15 Order to meet the case of new products or processes which have been developed or expanded under war conditions.

Copies of the order can be obtained from H.M. Stationery Office, or through any bookseller. All inquiries regarding the Order should be addressed to the Iron and Steel Control, Ashorne Hill, near Leamington Spa.

The changes which have been made in the Control of Iron and Steel (No. 15) Order, 1941, as varied by the No. 16 and No. 17 Orders, are as follow:—

1.—In the First Schedule, for the words "Molybdenum Metal," are substituted the words "Molybdenum Metal in powdered or sintered form," and for the words "Tungsten Metal," the words "Tungsten Metal in powdered or sintered form."

2.—In the Third Schedule the items (iv), (v), (vi) and (vii) are deleted.

3.—The following new categories are inserted at the end of the Fourth Schedule:—(xvi) tinplate, 1 ton 6 cwts., or 13 double boxes, £40; (xvii) terneplate, 1 ton 6 cwts., or 13 double boxes, £40; (xviii) blackplate, 1 ton 6 cwts., or 13 double boxes, £40; (xix) silver-finished plate, 1 ton 6 cwts., or 13 double boxes, £40.

4.—In the Related Schedules, those numbered 1, 13, 14, 22, 26, 27, 28, 29, 30, 31, 32, 33, 36, 64, 66, 78 and 80, respectively, are revoked, and eighteen further Related Schedules, lodged with the Minister of Supply for the purpose of the Order, certified by him in accordance with paragraph (1) of Article 8 of the Order, and numbered 98 to 115 respectively inclusive, are substituted therefor.

Iron and Steel Workers' Supplementary Clothing Coupons

Copies of the explanatory leaflet issued by the Board of Trade laying down the procedure (detailed in our last issue) for the distribution of supplementary clothing coupons to iron and steel workers are now available at local offices of the Ministry of Labour. The leaflet lists the workers who are entitled to these extra coupons, the number of coupons varying from 15 to 45, according to occupation. Since the issue of the leaflet, the Board of Trade—on representations of the British Employers' Confederation—has agreed that, where employees who are entitled to receive supplementary coupons owe coupons to their employer in respect of clothing supplied by the employer, the employer, when distributing the supplementary coupons, will be entitled to withdraw the appropriate number of coupons owed to him by the worker concerned.

Works Maintenance Men

Over a quarter of a million firms are affected by the recent Order made by Lord Reith, Minister of Works, calling for a return from all direct employers of labour engaged in building or civil engineering activities. The labour concerned is in effect the maintenance force of the country and consists of those fairly large numbers employed by housing estates, banks, blocks of flats, factories, works, schools, etc. Even the small village stores which employs a carpenter is concerned. Information as to the whereabouts of these men is vital to the war effort, yet thousands of employers have so far failed to make the return—perhaps because they have not realised that they are concerned. All employers, in whatever industry they may be, are required to furnish returns of any labour directly employed by them on building or civil engineering activities. Only building or civil engineering contractors, who are already registered, are not required to make the return.

The employees concerned include, joiners, carpenters, bricklayers, slaters, tilers, painters, plasterers, plumbers, glaziers, builders' labourers, and all persons engaged generally in the construction, reconstruction, alteration, repair, maintenance, decoration or demolition of buildings or fixed works of construction, including excavation, levelling, the making of earthworks and foundations, the laying of pipes and sewers, the construction of roads and railways, tracklaying, etc. This is a compulsory return and failure to make it renders a person to whom the Order applies liable to the penalties prescribed in the Defence Regulations. Copies of the form B.C.E.4, on which the return must be made, have been available at all Employment Exchanges since November 12. All employers of such labour are advised, in their own interests as well as those of the country, to make the return at once. Any building or civil engineering labour not so returned may be regarded as non-essential and transferred elsewhere.

British Property in Enemy Territory

The Board of Trade announce that real and personal property situated in Bulgaria, Finland, Hungary, Roumania and in Japan and the Japanese Empire, belonging to persons and companies of British nationality resident or registered in the United Kingdom of Great Britain and Northern Ireland, is now eligible for inclusion in the register of British property in enemy territory, which has hitherto been confined to such property in German and Italian territory. Returns for the register should be rendered on the requisite form, which may be obtained from the Assistant Secretary for Finance, Board of Trade, New Oxford House, Bloomsbury Way, London, W.C.1.

The Board of Trade also announces that, in view of the state of war existing between this country and Japan, the Register of Enemy Debts compiled by the Finance Department of the Board is extended to include all debts and other moneys owing to persons in the United Kingdom from persons who, by reason of the application of the Trading with the Enemy Act, 1939, to Japan and territories in Japanese occupation, become enemies. The provisions of the Trading with the Enemy Act now extend to Japan proper, Korea, Formosa, Karafuto, Kwantung Leased Territory, and the Japanese islands in the Pacific, including those under Japanese mandate, and to Manchuria, Indo-China, the occupied areas of China, and to Thailand.

Applications for Trade Marks

The following list of applications to register trade marks has been taken from the "Trade Marks Journal":—

"YELSEN"—Hydraulic pumps, engines, etc. DUDLEY GEORGE JONES, Rectory Lane, Britimp Works, Sidcup, Kent.

"RONDAVEL"—Steel aircraft hangars. HEAD, WRIGHTSON & COMPANY, LIMITED, Teesdale Iron Works, Thornaby-on-Tees.

"SIMBRAX"—Alloys of non-precious metals. JAMES BOOTH & COMPANY (1915), LIMITED, Argyle Street, Nechells, Birmingham, 7.

"ELEKTRON"—Chemical products used in the manufacture and working of metals, etc. MAGNESIUM ELEKTRON, LIMITED, Abbey House, Baker Street, London, N.W.1.

"BRECO"—Electrical transformers and alternating-current arc welding apparatus. BRENTFORD TRANSFORMERS, LIMITED, 234A, High Street, Brentford, Middx.

"CERROMATRIX" and "CERROBASE"—**Metal alloys.** CERRO DE PASCO COPPER CORPORATION, c/o Stevens, Langner, Parry & Rollinson, 5 to 9, Quality Court, Chancery Lane, London, W.C.2.

[Application to the Cutlers' Company, Sheffield]

"ZIP"—High-speed steel. CRUCIBLE STEEL COMPANY, Granville Street, Sheffield, 2.

"PEDESTAL"—Steel stamps and dies. EDWARD PRYOR & SON, LIMITED, Broom Street, Sheffield, 10.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Slough Die Casting Company, 434, Perth Avenue, Slough—£600. J. C., F. C., and W. Wilby.

G. W. Groom Engineering—£2,000. G. W. and M. R. Groom, 73, Colborne Way, Worcester Park, Surrey.

Wolverwire, 234, Bilston Road, Wolverhampton—Manufacturers of non-ferrous metal wire, etc. £1,000.

G. L. Murphy, Imperial Works, Menston, near Leeds—Engineers, etc. £10,000. G. L. and J. D. Murphy.

Clayhill Engineering Company—£5,000. J. Ismay, 8, Auckland Road, Doncaster; R. A. Sawyer and J. Bradshaw.

Atterton & Ellis—Engineers and ironfounders, etc.—£5,000. G. O. and R. K. Boardman, Abbotts Hall, Sturmer, Essex.

Wagon Maintenance & Sales—£100. S. Percivall, 44, Cheyneys Avenue, Canons Park, Edgware, Middlesex, subscriber.

Kingcliffe Engineering Company, Railway Works, Birds Royd Lane, Rastrick, Brighouse—£2,000. J. Cliffe and R. Grange.

Deshaw Reclamation Process—Reclaimers of metals, etc. £1,000. Z. Deshaw, 13, Valentine Road, Ilford, Essex, subscriber.

Newburgh Engineering Company, Newburgh Engineering Works Bradwell, Derby—£1,000. I. Middleton and J. I. Hale.

Kingsdown Silica Company, 1, Munro Terrace, Cheyne Walk, London, S.W.10—£100. B. D. March and F. R. Cullingford.

W. G. & R. Gilbert, 86-88, Queen Victoria Street, London, E.C.4—Engineers and ironfounders, etc. £2,000. W., R. W., and G. Gilbert.

R. Minnikin & Company—Founders, metal workers, etc. £1,500. G., A. H., and R. R. Minnikin, 44, Dennison Crescent, Birtley.

M. H. Berlyn Company, Roe Works, Dudley Road, Halesowen, Worcs—Pressed metal goods. £5,000. M. H. Berlyn and A. H. Allely.

W. G. Bedford, 35, William Street, Slough, Bucks—Electrical and mechanical engineers. £10,000. W. G. and W. W. G. Bedford.

Trawlex, 5, Lincoln's Inn Fields, London, W.C.2—Ironfounders, engineers, etc. £3,500. C. Alexander, E. C. D. Rawlins, T. Girtin, and L. J. Thompson.

Shalson Manufacturing Company, Granville Park Works, Brettenham Road, Edmonton, London, N.18—Engineers, etc. £2,000. S. H. and I. M. Allen.

A. G. Peacock & Company, "Potterells," North Mimms, Hatfield, Herts—Engineers, scientific instrument manufacturers, etc. £3,000. A. G. and G. E. Peacock.

Powley Products, Jubilee Mills, Blaina, Mon—Manufacturers of tinplate cleaning materials, etc. £2,100. G. F. Powell, F. W. J. Leyshon, and H. C. Williams.

Aero Heat Treatments—Heat treaters of metals, etc. £2,000. H. Frost and E. S. Hales, "Newlands," Blackrock Road, Sutton Coldfield, near Birmingham.

M. R. Proudlock (Contractors)—Works contractors, ironfounders, engineers, etc. £10,000. M. R. Proudlock, 36, Moor Court, Gosforth, Newcastle-upon-Tyne.

C. M. Manufacturing Company (Birmingham), 64, Soho Hill, Hockley, Birmingham, 19—Engineers and brassfounders. £5,000. C. H., H., and C. I. Mitchell.

H. P. Smith & Company (Barnsley), Chronicle Buildings, Peel Square, Barnsley—Colliery furnishers and suppliers, agents and factors. £20,000. H. P. and K. Smith.

W. H. Homer—Engineers, founders, etc. £1,000. W. H. Homer, Junr., 53, Smithfield Road, Blackenall, Walsall: W. H. Homer, Senr.: V. M. Homer, and G. Jarvis.

W. J. Coles & Son (Engineers), Station Road, Bracknell, Berks—Agricultural engineers and founders. £10,000. E. F. Burgess, B. J. O'N. Sealy, and W. H. Bunch.

Cox & Humphries, 11, East Street, Bridport, Dorset—Manufacturers of hardware, engineers' sundries, tools, etc. £10,000. A. J., F. E., W. M., A. D., and G. J. Humphries.

North London Toolmakers—£3,000. S. B Rogers, E. A. W. Dymond, F. W. Barker, and J. C. Thompson. A. P. Hollinshead, 97, Cannon Street, London, E.C.4, subscriber.

Company Meeting

Hale & Hale (Tipton) Limited

A YEAR OF CONTINUED PROGRESS

The fifth annual general meeting of the members of Hale & Hale (Tipton), Limited, was held on Wednesday, December 10, at the Station Hotel, Dudley. MR. W. EDGAR HALE, J.P. (chairman and managing director), presided. The report of the auditors was read by Mr. S. C. Mallett, of Messrs. Roberts, Hall & Company, Birmingham.

Moving the adoption of the report and accounts for the year ending August 4, 1941, the chairman said: "We are still faced with the same very serious war outlook as we were faced with when we last met, but I am sure that we have nationally, in our own particular way, made enormous strides in the direction of improving our status to enable us to resist this monstrous problem which the world is being told is something marvellous, and its title is the 'New Order.'

"It is more than obvious to all, and it becomes more so each day, that this vile and infernal thing has for its foundation and its background nothing other than a scheme to serve the vicious and unscrupulous desires of one small 'clique' whom we know as the leaders of the Nazi party, led by one who, I suppose, is the most unprincipled blackguard that has ever had effrontery to elevate himself to the position of a great national leader.

"I am sure we can take great comfort as a nation in the improved position which we are enjoying to-day as compared with a year ago, but if ever we are foolish enough nationally to allow ourselves to sit back with the idea that our effort up to this date is sufficient ultimately to bring to an end this terrible war, we shall be making what might prove to be the greatest mistake the world has ever known, which might result in the complete dismemberment of the British Empire; and I will be sufficiently egotistic to say that the world would be all the worse for the dismemberment of the British Empire!

National Effort Not Enough

"There is no gainsaying the fact that at this date we still have a certain percentage of people who are not looking at this great national emergency as one to which they must contribute without their one all-absorbing idea of self gain. There is far too much of the self gain principle evident in this country, and it is indeed our greatest weakness, but it is not on any tremendous scale by comparison. It is a comparatively small percentage of mean and selfish people which we have in our midst who will be only too eager to share in the spoils of victory when they do come, as they will come, provided we are prepared to apply ourselves unselfishly to this colossal task.

"It does seem so strange that here we are engaged in this struggle to defend the only system of free government which has ever been presented to the world. We know it as 'Democratic Government,' and we are making all these enormous sacrifices to maintain all its privileges for 'the man in the street, which go with democratic government, *e.g.*, free speech, free Press, and other such invaluable things; and yet in the midst of it all there are lackadaisical people who are not pulling their weight, but are abusing, and to some extent stultifying the very principles of democratic government by which we very properly set so much store.

"We have lived in this country for so many generations, where every man has had the right to criticise his neighbour, even though his neighbour may be the Prime Minister himself, and we have come to regard it as sort of commonplace, whereas in reality it is the greatest heritage that mankind can ever enjoy; and, to bring to a conclusion this one aspect of the various problems to which I wish to refer to-day, I am delighted to say this—that in so far as your Company is concerned, and everyone associated with it, the record of our year's activities, I am sure, is one in relation to which the proprietors of the Company would have no cause to be ashamed.

Plant

"During the past year the whole of the Company's plant and equipment has been maintained in very good order, and has been adjusted and added to where necessary, so that the maximum production of desired commodities can be achieved and maintained. It is indeed remarkable how the plant has stood up to the very severe treatment which has been meted out to it during 1940-41.

Accounts and Taxation

"The annual report and accounts for the 12 months ended August 4, 1941, have been in your hands for some time, and I will not unduly occupy the time of the meeting in going into extreme detail. I would like, however, to point out in the first place that in comparing these accounts with the immediately preceding year's accounts that the former are for 12 months and the latter 13 months, and to get a correct comparison, therefore, the obvious adjustment is required.

"It will be observed that the trading profits for the year are roughly some £6,000 less than the previous year, but the difference in reality is negligible, as 1-13th of the previous year's figures has to be deducted from that year to get the correct comparison, and then the increase in taxation to the new level of 10s. in the £ for Income-Tax and the charge for Excess Profits Tax also has to be deducted, representing, roughly, another £5,000, so that the resultant figure is almost exactly as last year. As I pointed out then quite regardless of what any particular company's trading results are, the real cash results are dictated by the 'pre-war' standard which is agreed as between the Revenue authorities and the accountants to the company, and it is that amount that the proprietors of any company have to distribute, and no more.

"Taxation is, of course, based upon an incredibly high figure, but we have to content ourselves with the thought that we have got to fit in with a national financial network which our national leaders tell us is the very best in the national interest, but I fear that it is becoming self-evident that industry cannot continue to have its liquid funds drawn on at the present rate, and that adjustments will be inevitable before very long.

Burden of New Plant

"The Chancellor of the Exchequer in his last Finance Act made provision for the ultimate return of some part of the Excess Profits Tax at some future date, which will undoubtedly prove great help one day, and the idea coincides exactly with a suggestion which was made at this Company's annual meeting last year, but whether we can take credit for sowing the first seed in the Chancellor's mind we do not know. Yet, as I have already stated, it has now become evident that something will have to be done in the form of some immediate alleviation before very long, and although it does not apply to this particular firm, it is the continued drain upon banking accounts to meet the continuous purchases for new items of plant and equipment, added to which the drain to meet E.P.T. is gradually bringing many firms into a state of financial indebtedness to their bankers which is not healthy.

"In so far as this Company is concerned, I would state that the accountants have agreed with the Revenue Authorities the amounts due from the Company since the last meeting, and remittances to cover the same have already been handed over to the Exchequer.

"Out of the approximate £21,000 has to be provided depreciation and obsolescence amounting to £5,000 odd, and directors' fees amounting to £350. From the balance has to be deducted the two Preference dividends, as shown, amounting to approximately £3,000 net, and the proposed Ordinary dividend amounting to approximately £4,000, leaving a balance of £8,000, to which has to be added approximately £13,000 brought in from last year, again making a total of approximately £21,000, from which it is proposed to devote to the two reserve accounts £10,000, as shown, and to carry forward to next year approximately £12,000.

Dividends and Appropriation

"I have no doubt that many of the proprietors will feel that distribution on the Ordinary shares of 7½ per cent. is small in comparison with the profits available, but your Board feel that prudence and the stability which arise therefrom is the correct course to pursue in these uncertain times, so that the Company will be well able to withstand the bad years as and when they come in their inevitable cycle. Not only the interests of the proprietors, but particularly, perhaps more so, in the interests of all those people who represent the employees of the firm in varying capacities, to whom Hale & Hale represents the basis of their livelihood.

"I expect also that some proprietors would like to know roughly what is the relationship between the amount of the Ordinary dividend and the amount paid out during the year in wages and salaries—the figure is roughly 1-60th part.

"There has, in my opinion, been a tendency from the commencement of the industrial era in this country to regard the products of industry as the principal prerogative of the proprietors of any industrial concern. In my opinion industry is intended to form the basis of livelihood for the staff and workpeople as a whole, and it is their interests that really represent a first charge upon commercial undertakings.

"I would now like to devote your attention for a moment to changes in the balance sheet. On the liabilities side the capital structure remains unaltered, the various reserve accounts have been adjusted in accordance with your resolutions taken at the last annual general meeting, and I would venture to suggest that they represent a healthy situation. The amount owing to bankers now disappears from this side of the balance sheet, and a credit banking position appears on the assets side. And, referring now to the assets side, there is an increase in the expenditure upon land and buildings to the extent of some £9,000. Realisations of plant and machinery, less calculated amounts for depreciation, reduce this figure by about £4,000 from last year, and loose tools have been further reduced to the figure of £2,400. Loose tools can never be looked upon as being a particularly high-class asset. The stocks on hand are also somewhat reduced, and so also sundry debtors. In this connection it will be observed that the creditors are reduced by approximately the same amount.

"During the course of the year such items as Canteen Service, Home Guard, Fire Watch Service, and other items of a similar character have made innumerable calls upon the time of the management, and I am fully satisfied that everyone concerned up to this date has produced a result that can only be regarded as very satisfactory.

Staff and Employees

"Later in the meeting a proposition will be put before you for your approbation by Mr. Leppington for returning thanks to all concerned for their energetic efforts during the year, which have produced such satisfactory results, and while I am most desirous of not encroaching upon Mr. Leppington's domain, I would like to add my personal word of thanks as your chief officer in the organisation. Many people have the erroneous impression that the managing director is the 'be all' and 'end all' of any commercial enterprise; such, however, is definitely not the case. For my own part, I am very conscious of the enormous help which I receive from everyone concerned, without whose help it would be impossible for me to fulfil my office. I am most grateful to them for their most loyal support, and I do trust that they are equally as satisfied with the service which I have rendered to them in return."

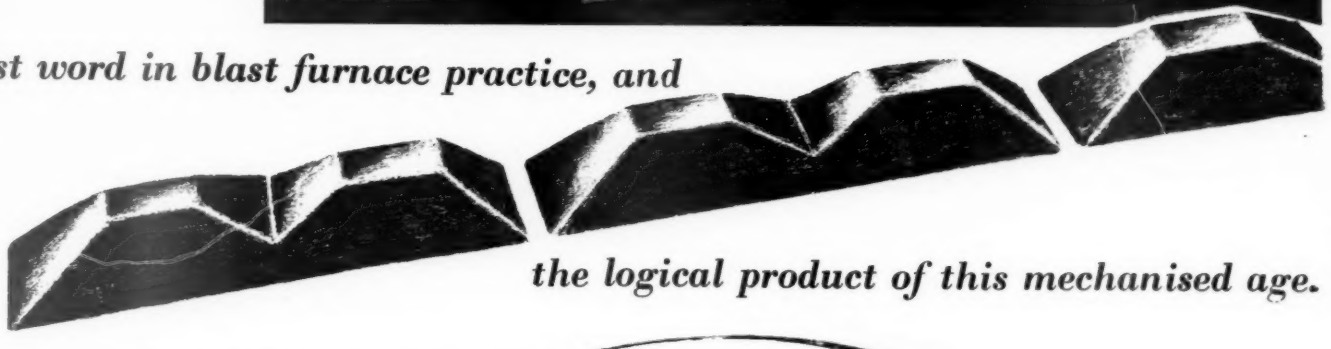
Mr. Clarkson, in seconding the resolution and motion put by the Chairman that the reports and accounts be adopted, said:—

"Our Company is making steady progress, both in relation to research to further improve our methods of manufacture and general organisation. And now I would like to express on your behalf and that of your Board of Directors, our appreciation and thanks to your managing director, Mr. W. Edgar Hale, for his work during the period just reviewed by him. He is a man of great ability, resource, and vision, as many of you already know, and, as your Board of Directors know, he gives unstintingly, to the service of our company the benefit of these great qualities he is so fortunate in possessing. He is a great leader, standing before us as a shining example of efficiency and energy, and I am sure you all join me in the hope that he will be spared to give us many more years of his irreplaceable service and guidance."

The retiring directors, Mr. W. Clarkson and Mr. R. C. Leppington, were re-elected, and the auditors, Messrs. Roberts, Hall & Company, were also re-appointed. Mr. R. C. Leppington paid a tribute to the splendid support and wholehearted enthusiasm of the staff and employees during the past 12 months, and the meeting closed with a hearty vote of thanks to the chairman and directors.

STANTON

Last word in blast furnace practice, and



the logical product of this mechanised age.

ITS ADVANTAGES ARE MANIFEST

THERE IS NO SAND

THERE ARE NO SOWS

THERE IS A NEW MODERN SHAPE

designed to facilitate stacking

IT IS MADE IN STANTON, HOLWELL AND RIXON'S BRANDS

The chemical analysis and physical properties of our three well-known brands remain unchanged, and the new pig combines the merits of an established formula with the benefits of the most advanced form of manufacture.

THE STANTON IRONWORKS COMPANY LIMITED, Near NOTTINGHAM

The Week's News in Brief

Trade Talk

KELVIN, BOTTOMLEY & BAIRD, LIMITED, Glasgow, and Henry Hughes & Son, Limited, London, scientific instrument makers, have decided to merge the distribution arrangements of their marine departments.

PRICES OF NEW BRASS TUBES, copper tubes, etc., have been raised, latest quotations (per lb.) being as follow:—New brass tubes, etc.: Solid drawn tubes, 1s. 2d.; brazed tubes, 1s. 4d.; rods, drawn, 11¼d.; rods, extended as rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10¼d.; rolled metal, 10¼d.; yellow metal rods, 9d. Copper tubes, etc.: Solid drawn tubes, 1s. 3¼d.; brazed tubes, 1s. 3¼d.; wire, 10d.

THE MARINE INSTRUMENT departments of Kelvin, Bottomley & Baird, Limited, Glasgow, and Henry Hughes, Limited, London, have been amalgamated in a subsidiary company, Marine Instruments, Limited, with the object of expediting and improving production and service by the exchange of ideas, the concentration of manufacture on the best instruments of each firm, and the elimination of overlapping. The main activities of the undertakings are not affected by this new arrangement.

NEW PROVISIONS affecting machinery licensing are contained in the Machinery, Plant and Appliances (Control) Order, 1942, issued by the Board of Trade. The Order replaces the whole of the previous Machinery and Plant (Control) Orders and Machinery Plant and Appliances (Control) Orders, with the exception of the three General Licences, and embodies certain amendments and additions. The new provisions have the effect of subjecting to licence certain additional machinery and plant and of exempting from licence (*a*) machinery, plant and appliances supplied to a manufacturer of machinery or plant not included in the Schedule to the Order, and for use with any such machinery, plant and appliances made or in course of construction; and (*b*) prime movers or electrical machinery or plant for driving machinery or plant for the supply of which a licence has been granted under the Orders and for which driving means is not already available. Application forms for licences to acquire machinery, plant or appliances falling within the Schedule to the Order may be obtained from the Machinery Licences Division, Board of Trade, 1-6, Tavistock Square, London, W.C.1.

CONTRIBUTIONS TO WEST OF SCOTLAND hospitals, charitable institutions and war relief funds for the year 1941 by employees of local firms include the following:—Coltness Iron Company, Limited, £7,738; Alexander Stephen & Company, Limited, shipbuilders, £3,649; Mirrlees Watson Company, Limited (foundry and engineering departments), £722; David Rowan & Company, Limited, engineers, £480; Barr & Stroud, Limited, scientific instrument and apparatus makers, £400; Scotia Bolt Works, £275; Lancefield Foundry Company, Limited, £36; Babcock & Wilcox, Limited, Dumbarton, £330; Etna Iron & Steel Company, Limited, £120; Springfield Steel Company, Limited, £63; G. & J. Weir, Limited, Holm Foundry, Cathcart, £1,000; Harland & Wolff, Limited, Govan Shipyard, £100 (13th contribution to the City of Glasgow Central War Relief Fund); Summerlee Iron Company, Limited, £2,048; Walter Macfarlane & Company, Limited, Saracen Foundry, Possilpark, £298; Argus Foundry, Limited, £157; Denny & Bros., Limited, Engine Works, £565; North-West Rivet, Bolt & Nut Factory, Limited, Airdrie, £84; Hardie & Gordon, Levenbank Foundry, Dumbarton, £63; Shaw Glasgow, Limited, £324.

THE WALES REGIONAL BOARD of the Production Executive has set up a West Wales Advisory Panel of eight employers and eight trade union representatives to advise the Regional Board on all matters of war production in West Wales, including the fuller use of the capacity available in the district. The members are:—Col. J. M. Bevan (Briton Ferry Steel Company, Limited), Mr. Arthur J. Burn (Llanelly Foundry & Engineering Company, Limited), Capt. H. Leighton Davies (Baldwins, Limited), Mr. W. J. G. Evans (South Wales Miners' Federation), Mr. R. M. Evans (National Union of General and Municipal Workers), Mr. F. Gorst (Amalgamated Engineering Union), Mr. T. O. Lewis (Richard Thomas & Company, Limited), Mr. F. C. Mannox (I.C.I. (Metals), Limited), Capt. Myrddin Morris (Baglan Bay Tinplate Company, Limited), Mr. Morgan R. Rees (Iron and Steel Trades Confederation), Col. G. E. Aeron-Thomas (Emlyn Anthracite Colliery, Limited), Mr. D. Vaughan Thomas (West Wales Allied Engineering Trades), Mr. T. Vincent (Electrical Trades Union), Mr. W. J. Wardle (Transport and General Workers' Union), Mr. Ezekiel Williams (Richard Nevill & Company, Limited), and Mr. Llewellyn Williams (Amalgamated Society of Woodworkers).

Personal

DR. J. E. HURST, past-president of the Institute of British Foundrymen, has been appointed a Justice of the Peace for the City of Lichfield.

MR. THOMAS HAY, who retired some years ago from Loanhead Ironfoundry, has just celebrated his golden wedding with his wife and family at Main Street, Lasswade, Midlothian.

MR. A. S. WALL, the South Wales pig-iron representative of the Stanton Ironworks Company, Limited, who was bombed out of his house about a year ago, has now returned to his old address at No. 14, Palace Avenue, Llandaff, Cardiff.

MR. EUGENE G. GRACE, President of the Bethlehem Steel Company, and an outstanding member of the iron and steel industry in the United States of America, has been awarded the Bessemer Gold Medal for 1942 by the Council of the Iron and Steel Institute.

AT THE ANNUAL MEETING of the Meehanite Research Institute of America, MR. OLIVER SMALLEY, O.B.E., was re-elected president. Mr. A. C. Denison, of the Fulton Foundry & Machinery Company, was presented with a gold watch for meritorious work.

MR. FRANCIS FRASER, who has been secretary of the British Thomson-Houston Company, Limited, for over 40 years, and a director for over 27 years, retired on December 31. He went to the B.T.H. Company from the Edison General Electric Company, which he had joined in the U.S.A.

MR. VERNON PROCTOR, of Sheffield, has been appointed Regional Controller for the Ministry of Supply for both the East and West Riding in succession to Mr. J. K. Anderson. Mr. Proctor has been with the Ministry of Supply since October, 1939. For 18 years before 1921 he was associated with Cammell Laird & Company, now part of the English Steel Corporation, Limited. From 1921 up to 1939 he was in the steel and engineering business on his own account.

MR. J. M. RINGQUIST has retired after 46 years' service with Head Wrightson & Company, Limited, Teesdale Ironworks, Thornaby-on-Tees. Mr. Ringquist joined the firm as a draughtsman and subsequently became chief engineer and director. To mark the occasion he received a presentation on Tuesday last from the directors, officials and staff of the company. Mr. Ringquist has designed and superintended while with the firm the erection of colliery plants, blast-furnace plants, dock and harbour works, coal-handling plants and many other large undertakings, and has been responsible for many patents.

Obituary

MR. WILLIAM MORTON, managing director of the Atlantic Engine Company (1920), Limited, Wishaw, died recently.

MR. RICHARD RIDYARD, of Leigh, a former president of the Wigan branch of the Lancashire, Cheshire, and North Wales Engineers' and Boilermen's Federation, has died at the age of 80.

MR. WILLIAM OUBRIDGE, of Coventry, a well-known Midland engineer, has died at the age of 61. He was the founder of the British Piston Ring Company, Limited, and until a few months ago was managing director of the firm.

Contracts Open

Huntingdon, January 30—Iron fencing, tools, etc., for the year ending March 31, 1943, for Hunts County Council (County Roads and Bridges Department). Mr. Thos. H. Longstaff, county surveyor, Walden House, Huntingdon.

London, S.W., January 29—Sewer castings, tools, iron, steel, etc., for six or 12 months from March 31, for the Lambeth Borough Council. Mr. G. H. Buckett, Town Hall, Brixton Hill, London, S.W.2.

New Year Honours

The following list of awards in the New Year Honours List is additional to that published in our last issue:—

MR. GEORGE TRISTRAM EDWARDS, who receives a knighthood, is a director of the Consett Iron Company, Limited, and the Consett Spanish Ore Company, Limited, and vice-chairman and joint managing director of Smith's Dock Company, Limited. He is chairman of the Ship Repairers' Central Council.

MR. HERBERT HENRY HARLEY, chairman and joint managing director of the Coventry Gauge & Tool Company, Limited, has been made C.B.E. for services to the Admiralty.

MR. TOM REGINALD CURTIS, manager of the armour plate rolling mill of Thos. Firth & John Brown, Limited, receives the M.B.E.

MR. WILLIAM EDWARD CLEMENT, chairman and managing director of Thomas & Clement, Limited, Morfa Engineering Works, Llanelly, and Glanmor Foundry, Limited, Llanelly, and chairman of the Welsh Engineers and Founders' Association, is a recipient of the C.B.E.

MR. GEORGE MACDONALD, who has been awarded an O.B.E., is a director of E. Chalmers & Company, Limited, metal merchants, Edinburgh, and has been lent by the firm to the Ministry of Aircraft Production.

BRIG. E. P. READMAN, formerly assistant sales manager in Sheffield for the English Steel Corporation, Limited, and later representative of the firm's Birmingham works, has received the C.B.E.

MR. T. DOOLEY, who receives the M.B.E., is superintendent of the gun and carriage department of Metropolitan-Vickers Electrical Company, Limited.

MR. G. H. HOULDEN, assistant shipyard manager of Vickers-Armstrongs, Limited, receives the M.B.E.

MR. W. MACHIN, who has received the M.B.E., is manager of the iron, steel and bronze foundries of Vickers-Armstrongs, Limited.

MR. A. E. BURNS, a foreman employed by Sir W. G. Armstrong Whitworth Aircraft, Limited, has been awarded the British Empire Medal.

MR. H. CROOK, who receives the British Empire Medal, is foreman of the tank department of Armstrong Siddeley Motors, Limited.

MR. J. HINDLEY, foreman tester in the employ of the Vulcan Foundry, Limited, receives the British Empire Medal.

MR. N. MAKEPEACE, foreman boilermaker with the North Eastern Marine Engineering Company, Limited, has been awarded the British Empire Medal.

MR. G. PIERSON, who also receives the British Empire Medal, is a chargehand coppersmith and tank maker with Vickers-Armstrongs, Limited (Supermarine Works).

Reports and Dividends

(Figures in brackets refer to the previous financial year.)

Foster, Yates & Thom—Dividend of 5% (same).

Speedwell Gear Case—Trading profit to August 31 last, £21,731 (£30,305); ordinary dividend of 10% (same), plus a bonus of 2½% (nil).

Wolverhampton Die-Casting Company—Net profit for the year ended June 30, £17,762; final dividend of 7½% on the ordinary shares, making 12½%; forward, £8,037 (£2,193).

Universal Grinding Wheel—Trading profit, after E.P.T., to September 27, 1941, £164,362 (£172,583); depreciation, £29,780 (£27,865); war damage insurance, £5,500; income-tax, £78,000 (£66,000); balance, £47,482 (£75,118); participating dividend on the preference shares of 1% (2%); ordinary dividend of 10% (same), free of tax; forward, £6,689 (£3,207).

Stewarts and Lloyds of South Africa—Profit for the year to June 30, 1941, after taxation, debenture interest, fees, and depreciation, £272,238 (£280,136); to general reserve, £50,000 (£45,000); to contingencies reserve, £105,000 (£10,000); to debenture redemption reserve, £5,325 (£5,023); final ordinary dividend of 10%, making 20% (15%); forward £78,398 (£83,985).

Broom & Wade—Trading profit for the year to September 30, £188,701 (£99,944); depreciation £12,631; income tax and E.P.T., £135,350 (£39,984); dividends on the 6% cumulative preference shares £6,900; interim dividend of 7½% on the ordinary shares, £11,250; final dividend on the ordinary shares of 15%, making 22½% (same), £22,500; forward, £33,954 (£33,884).

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Raw Material Markets

The licensing arrangements for iron and steel are operating very satisfactorily. Business is now quite straightforward, the Control authorities issuing permits to consumers according to their priority rating. Non-essential users are unable to obtain very much metal, so insistent is the demand for the war effort. Thus, the iron and steel maker has been relieved of the task of discriminating among the various applicants for supplies, and it is his chief duty to raise his output to the highest possible level and to despatch supplies according to the directions of the Control.

Pig-Iron

MIDDLESBROUGH—Common foundry iron is not now made on any appreciable scale on the North-East Coast, where producing units are fully occupied on the manufacture of basic iron for the steel industry. Consequently, consumers of foundry iron are procuring their supplies from the Midlands, makers in that area being in a position to entertain orders for all requirements. These are not very impressive, as the light-castings trade, the main support of the foundry-iron market in normal times, is far from busy because of the restrictions imposed upon the trade in the interests of war production. Basic iron output is very gratifying, and there has recently been a slightly better production of hematite, although this type of iron continues to be reserved for special consumers only.

LANCASHIRE—Most of the heavy engineering foundries in this area are well placed for business, those associated with the electrical and machine-tool trade rarely being in a position to take on fresh commitments. Demand for pig-iron from these concerns is consistently good, but consumption among jobbing foundries and makers of light castings is at a comparatively low ebb, the volume of new business coming to hand in these sections being very small. Foundry iron is coming into this district quite steadily from makers in Derbyshire and Staffordshire, so that plants here are able to operate continuously.

MIDLANDS—The calls of the armaments and munitions drive on the heavy enginering foundries are still tending to increase, and may be expected to do so still further during the year just started, as the capacity of these works for satisfying the needs of Government departments, etc., is very large. Machine-tool works are also sharing in Government orders. As far as raw materials for these sections are concerned, the hematite situation is the most difficult. Only small quantities of this material are being released for consumption, and then only for special classes of consumers. Users who would normally utilise this type of iron, but who are able to obtain satisfactory results without it, are expected to make do. Refined, low- and medium-phosphorus irons are coming forward slightly more freely, so that foundries are not handicapped in this respect. The position of light-castings manufacturers is as dull as it has been for some months past, with little, or no, likelihood of change for the better while the need for concentrating on production of war materials persists.

SCOTLAND—Pig-iron is by no means freely available to consumers in this district, but important users are getting their immediate needs met satisfactorily. Some relief was afforded by the short break at the turn of the year, but the effect of this has just about worn off by now and pressure is again insistent. Heavy engineers, marine engineering foundries and certain other branches are fully booked up, but activity in the Falkirk and district light foundry trade remains restricted. If there should be any change in the building policy of the Government this will doubtless be reflected in the order-books of light-castings makers, but until such time business is bound to be quiet.

Coke

Apart from a few slight delays in the supply of foundry coke the position is quite satisfactory, and users are able to get all they require. Many consumers have appreciable stocks on their hands, which stand them in good stead if fresh supplies are held up. The quotation for Durham blast-furnace coke, f.o.t. makers' ovens, has been raised by 9d. per ton to 37s. 6d., by agreement with the Iron and Steel Control.

Steel

Joists, sections and certain other structural steel products are in rather better demand in some districts, but structural engineers' requirements generally are still only moderate in their extent. Plate mills are mostly fully booked up with business from shipbuilders, boiler and tank makers, and deliveries of plates to structural engineers and other less essential users are subject to a certain amount of delay at times. Despite some slowing down of demand, sheet makers continue to enjoy active trading conditions. Makers of special alloy steels are operating to capacity, with every prospect of outputs being cleared over a long period ahead.

Scrap

A new national campaign to recover 40,000 tons of iron and steel scrap a week was announced on Monday by Lord Reith, Minister of Works and Buildings, who said that they would carry their collecting organisation into every town and village, to every house and farm, to bring into the national production every piece of idle iron and steel in the country. It is greatly to be hoped that this new scheme will be successful, as the need for bringing out all scrap metal lying idle is of paramount importance at the present time. Scrap "drives" have been inaugurated with rather monotonous regularity in the past and have not been accorded the support they should have received. The nation can no longer afford to sit back and view these efforts lackadaisically. Stricter measures of compulsion are undoubtedly warranted. The 40,000 tons a week which it is hoped to get from the new national drive will be in addition, of course, to the normal supplies of scrap which arise through scrap merchants in the ordinary course of business. The campaign will fall roughly under three heads: (*a*) A national survey of all idle iron and steel in lots of over 3 tons in any one place (this survey is being accelerated and it will be made compulsory to disclose all such metal); (*b*) clearance of local dumps to which lots of less than 3 tons should be sent as quickly as possible; (*c*) acceleration of the collection of railings. Under the national survey will be included disused pithead gear, bridges, rail tracks and factory machinery, as well as the large accumulation of loose scrap.

Metals

COPPER—Consumers of copper in this country have been accustomed to the system of priority allocations for a long time past, and non-essential users do not expect to receive more than the small tonnages which are generally allocated to them. In the United States, however, it would appear that the scheme for the conservation of supplies is not yet quite in apple-pie order, although large-scale economies have already been effected. Meanwhile, essential needs are being readily met on both sides of the Atlantic.

TIN—It is understood that a deputation representing the London Metal Exchange met the Chancellor of the Exchequer and representatives of the Ministry of Supply yesterday (Wednesday) to discuss the Government control of tin. While the Japanese have been successful in denying the Allies use of tin supplies in Malaya, they have not been able themselves to make much use of the tin resources of the conquered territory. A statement broadcast by Singapore radio reveals that the general position is that 60 to 70 per cent. of the tin production is no longer available to the British or Japanese. The rest is available to the British only. The question of the construction of new smelting capacity is now of considerable importance, both to the Allies and Japan, and it would appear that both parties could fairly easily bring into operation new plant. Tin smelting in the United Kingdom has fallen away in recent years, but it is believed that there are a number of small smelters now idle which could be brought into commission again without undue trouble and delay. In addition, the Banka smelter in the Netherlands East Indies has facilities for about 15,000 tons a year and the Belgian Congo for a similar tonnage, while some 10,000 tons might be smelted in Southern China and 5,000 tons in Australia. Annual production of the new United States refinery at Texas City is expected to exceed the 18,000 tons originally envisaged.

Following the Japanese occupation of tin-producing areas of Malaya, it is announced that special measures are to be taken, including the provision of the utmost facilities to Nigerian mines for the acquisition of plant and machinery to assist in the expansion of output. Nineteen tin-mining companies are operating in Nigeria and their tin shares reacted favourably to the news.

The Phelps-Dodge Corporation of America announces increased production and wider use of a silicon-bronze alloy, replacing tin in bearings and similar industrial products.

According to the December issue of the Tin Research Institute's Statistical Bulletin, revised figures for world production of tin give a total of 209,500 tons for the first ten months of 1941, against 187,600 tons in the corresponding period of 1940. United States deliveries totalled 8,355 tons in November, 1941, against 8,000 tons in October. U.S. deliveries in the first eleven months of 1941 were 135,642 tons, compared with 106,139 tons in the corresponding period of 1940. Tin consumption of the United Kingdom totalled 24,879 tons in the first ten months of 1941, against 24,904 tons in the corresponding period of 1940. World stocks of tin, including smelters' stocks and carry-over, increased by 4,736 tons during October, 1941, to 51,465 tons at the end of the month. Stocks at the end of October, 1940, were 53,890 tons. The Institute announces that, owing to the lack of information available in present circumstances, the publication of the Institute's "Statistical Bulletin" is now suspended. Inquiries may still be sent to the Institute at Fraser Road, Greenford, Middlesex.

SPELTER—Zinc continues to play a major role in the production of war materials, so that it is necessary to avoid extravagant usage of the metal. Urgent requirements are being readily satisfied.

LEAD—While the supply of lead is fairly comfortable in this country, the Control are leaving nothing to chance, and it is becoming increasingly difficult for non-priority consumers to procure more than a small proportion of their needs.

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